DESIGNING FOR EDUCATION AT THE UNIVERSITY OF ILLINOIS ARBORETUM

BY

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THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Landscape Architecture in Landscape Architecture
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2010

Urbana, Illinois

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Abstract

This thesis project consists of the development of a framework for visitor experience at the University of Illinois Arboretum that focuses on educational programming and includes the design of a Discovery Center - a facility that serves as the locus for educational experience - at the core of the arboretum. The development of both the visitation framework and the Discovery Center is the result of a progression that begins with research and is followed by a series of design investigations that lead to the final design for the arboretum.

The thesis presented here is both a research and a design project because the site design stems from a synthesis of research regarding site context, educational goals and philosophies, and precedent studies. This research is integrated with design explorations and a theory of planting design that I have developed to produce a framework for visitor experience and detailed design of the Discovery Center. Determination of the arboretum's context involves investigation into the origin of the arboretum and the established mission and programmatic goals for the arboretum; investigation of the arboretum's unique situation within the local and university community and usage of the site by frequent and occasional visitors; consideration of site features such as topography, soils, and existing built elements; and evaluation of plans for future development of the areas immediately surrounding the arboretum and their potential influence on arboretum usage and offsite connections. Research on three educational philosophies - outdoor, environmental, and experiential education - inform the design by providing ideas about how an arboretum can best be developed as an educational institution and ways to facilitate different types of learning to satisfy programmed and unprogrammed educational goals throughout the arboretum. Evaluation of precedents including other arboreta, educational institutions, and literary examples provide a basis of information regarding educational concepts applicable to an arboretum setting and possible ways to implement these ideas on site.

Following research on site context, educational philosophies, and precedents, the design project evolves into a study of the expression of form in the landscape, a road development study, a spatial relationship analysis, an architectural prototype study, and the development of a theory in planting design. Explorations of landscape form are used to express ideas about educational goals and provide a meaningful design hierarchy throughout the arboretum. The road development study analyzes points of access to the arboretum and seeks to integrate the arboretum within its neighborhood setting while optimizing access for both frequent and occasional users. The spatial relationship analysis determines ideal locations for the Discovery Center within the arboretum to increase visibility and recognition from an exterior perspective, to facilitate access to the Discovery Center for varying group sizes and event types, and to establish effective relationships between arboretum elements. Architectural prototype studies identify ways to integrate notions of interior versus exterior spaces and provide functional educational facilities. The theory of planting design outlines the role of cultural and environmental influences in the development of plant communities - namely grassland, shrubland, savanna, and woodland - and seeks to express these relationships through planting design and maintenance practices throughout the arboretum.

The culmination of research and design exploration is the production of a detailed design for the Discovery Center, illustration of the framework for visitor experience throughout the arboretum, and application of planting design theory to various areas of the arboretum. The Discovery Center design involves identifying and spatially organizing the necessary educational facilities and developing a design language that supports the educational goals of these facilities. The framework for visitor experience includes providing a system of circulation throughout the arboretum, implementing wayfinding devices at key locations within the arboretum, and developing a system of visitor interpretation to emphasize arboretum program goals and enhance experience of the site. The application of planting design theory is used to further promote educational goals

within the arboretum and to illustrate the aesthetic differences between plant communities influenced to varying degrees by environmental factors and cultural factors.

The design project is followed by a post-design evaluation that identifies the success of the design in relation to the initial program goals, outlines lessons learned throughout the design process, and suggests next steps for further development of the arboretum. The purpose of this thesis is threefold: to explore methods of designing landscapes for educational purposes, to design the Discovery Center and a framework for visitation throughout the University of Illinois Arboretum with specific educational goals in mind, and to communicate the development of the project from initial concept through final evaluation.

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1.0 Introduction: Why Study an Arboretum?

There are two reasons why I have chosen to design an educational facility affiliated with an arboretum for my thesis project: the first reason is because I believe that the pursuit of education is a human process that enriches the individual and the collective, and the second is because I am passionate about plants. Designing landscapes for educational purposes is a synthesis of my previous experience as a horticulturist and as an environmental educator with my current studies of landscape architecture. My goal with this project is to explore the potential of the designed landscape to teach about plants, about ecology, and about the interface between humans and their environment.

I have chosen the University of Illinois Arboretum as the site for this project because it is situated literally at the intersection of the University community and the local municipal community, enabling it to function optimally as an amenity for a wide range of visitors. The arboretum has the potential to serve as a locus for educational outreach providing innovative curricular programming for a wide range of ages and abilities throughout these communities. The design for the arboretum will seek to increase its relevance within the community and increase visitation by synthesizing goals from the existing Arboretum Program Statement, assessing the needs of potential community and user groups, evaluating research in educational philosophies relevant to an arboretum setting, and incorporating programmatic aspects of other successful arboreta.

There are three primary design goals that have remained consistent throughout each phase and of this project. The first goal is to establish relevance at the arboretum by identifying and distilling the arboretum's distinct niche both locally and regionally. The second is to design for educational experiences at the arboretum by creating an educational locus for visitors and a framework for pedestrian connections throughout the arboretum that extends beyond the boundaries of the arboretum itself. The final goal

is to illustrate the relationship between plant communities and planting design through the demonstration of native Illinois ecology, principles and components of the designed landscape, and through the integration of design principles with ecological principles.

1.1 Project Scope

This thesis is both a research project and a design project in that it seeks to incorporate research on educational theory, precedent studies, and theories of planting design into the planning and design of a unique project site with specific theoretical and programmatic goals in mind. The research aspect of the project involves gathering detailed information about the project site and existing Master Plan, investigating concepts of experiential, environmental, and outdoor education, studying relevant institutional and literary precedents, and developing a theory of planting design applicable to an arboretum setting. This research is then used to develop programmatic goals for the University of Illinois Arboretum that can be directly applied to the design of the arboretum site.

The design portion of the project is approached at two scales. The larger scale is that of the entire 160-acre arboretum and consists of a revision to the Arboretum Master Plan of 1993. This revision takes into account the original goals of the Master Plan while making modifications to increase the relevance of the arboretum, to incorporate current neighborhood and university planning, and to demonstrate planting strategies that I have developed as part of the educational goals of the arboretum. The smaller scale is the detailed design of a 10-acre site upon which the Discovery Center is located. This site serves as the central educational locus within the arboretum and includes facilities necessary for year-round use of the arboretum by visitors. It also provides connections both physically and thematically to other areas of the arboretum in order to maximize the experiential potential for visitors to the arboretum.

1.2 Project Method

The thesis document is arranged to provide the reader with a comprehensive view of the project from beginning to end that follows the progression of the thesis as it was developed. It begins in Chapter 2 with detailed information about the arboretum's site, current status, and situation amidst plans for future development of the area surrounding the arboretum property. The educational program for the arboretum and the supporting research on educational theory and examples of educational design precedents follow in Chapter 3. Next, background information and additional research that influenced the design process are exhibited in Chapter 4 along with preliminary sketches and site studies of the arboretum. The final design presentation in Chapter 5 includes a walk-through of the Discovery Center area outlining facilities and amenities accompanied by graphic snapshots of key areas. Finally, Chapter 6 provides an analysis of the success achieved in the design based on the programmatic goals, suggestions for further development of the project, and a discussion about the potential of the thesis as a tool for taking the next step in implementation of educational amenities at the arboretum. The portrayal and organization of the thesis is intended not only to describe this particular project but also to make observations about the process of design and to act as a commentary on the practice of bridging the gap between thought, design, and the written word.

1.3 The Current Arboretum and a Brief History

Today's arboretum occupies 57 acres of property located between Lincoln Avenue and Orchard Street from west to east, Florida Avenue and the university president's estate to the north, and Hazelwood Drive to the south. Development of the arboretum began in 1990 as part of a master planning initiative for the 2,700-acre South Farms portion of the University of Illinois campus. At this time, 160 acres were designated to be an arboretum serving programmatic goals of teaching, research, and public service. This designated 160-acre site is roughly one mile from north to south and 1,300 feet from west to east,

forming an ‘L’-shaped tract of land that extends south past Hazelwood Drive to Windsor Road (Arboretum Advisory Committee 1993).

Between 1990 and 1993 a Master Plan for the arboretum was prepared as a collaboration between the Campus Arboretum Committee, the University Office for Capital Programs, and Sasaki Associates, Inc. (Arboretum Advisory Committee 1993). In 1997, a Program Statement outlining existing conditions and future goals for development of the arboretum was prepared by the Arboretum Program Statement Committee (Nevling et al. 1997). These two documents, the Master Plan, which is an illustrative plan view rendered drawing, and the Program Statement, a written report documenting the mission statement, program objectives, and arboretum elements, are the starting point from which my design and research project for the arboretum is derived.

The Master Plan depicted in Figure 1.01 is described in the University of Illinois Arboretum Sourcebook as follows:

> The Arboretum Master Plan is derived from the teaching, research, and public service mission of the arboretum and from the unique qualities of the site, including its vegetation, topography, and adjacent land uses. The plan consists of three primary use areas plus a maintenance area that serves them. The three areas include the core, the collections, and the habitats. The major organizing element of the plan is a tree-lined, north-south axis that extends southward from the main entrance of the president’s house.
>
> The formal core area lies astride the axis at the northern end. Immediately to the south of the core, across a new man-made pond, the collections and the habitats are located on the west and east of the axis respectively. This side by side relationship of the collections to the habitats maximizes opportunities for cross-teaching between these two parts of the arboretum. The main axis, or allee, serves as a strong organizing element for visitors in the southern parts of the arboretum; providing a direct link back to the core area and a clear demarcation of the collections and the habitats recreations (Arboretum Advisory Committee 1993).

Figure 1.01
Arboretum
Master Plan,
1993.

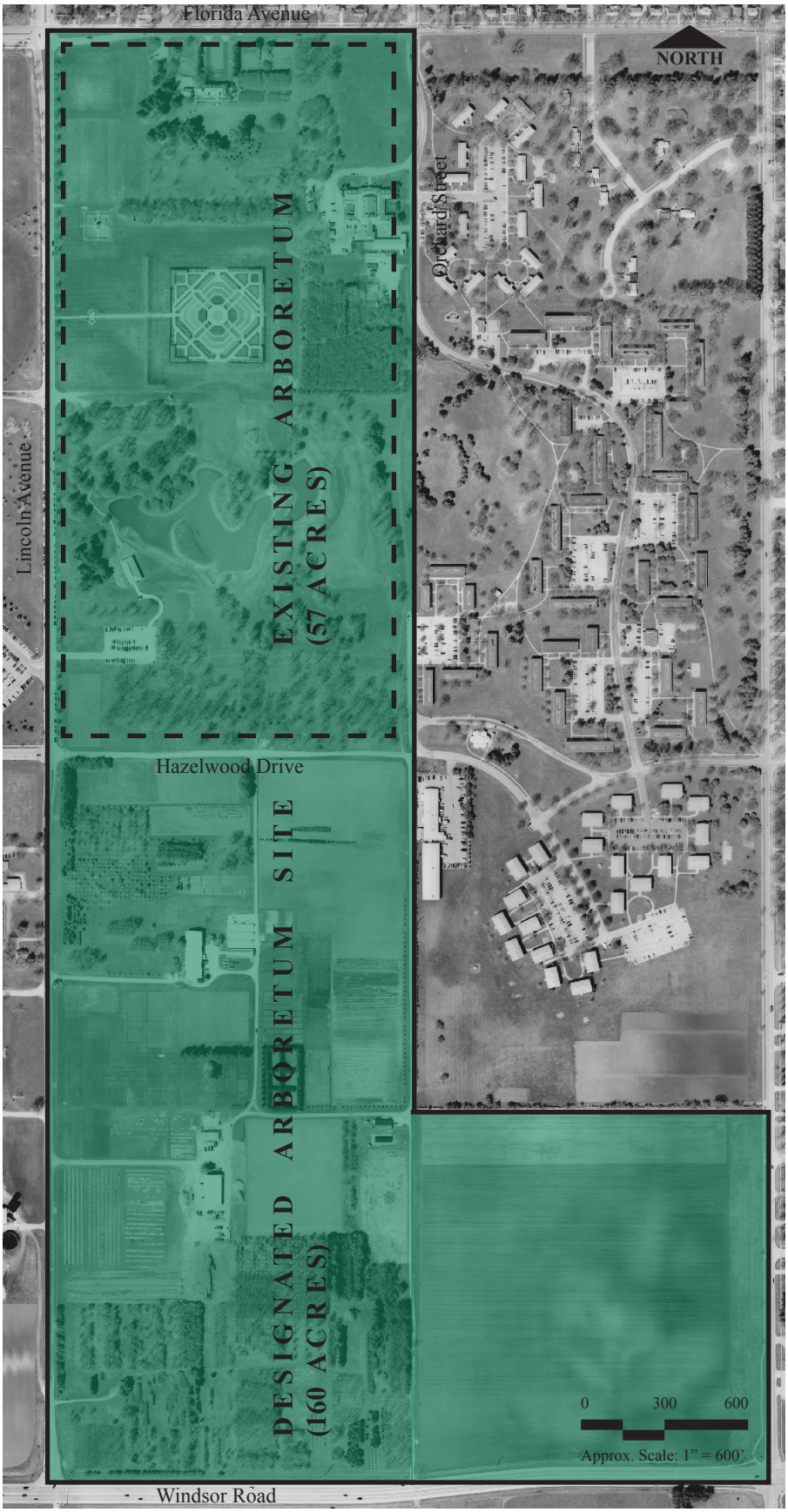

Figure 1.02 Arboretum Location Map (Aerial Photograph 2003 Courtesy of the City of Urbana).

The arboretum as it exists today includes some of the core elements and arrangements illustrated in the Master Plan. Figure 1.02 shows an aerial image of the site highlighting the 160-acre area designated for arboretum use and the 57 acres currently in use by the arboretum. Figures 1.03 through 1.06 are images of arboretum gardens that have been constructed on site to date and a map depicting the locations of these and other existing core elements described in the Program Statement is shown in Figure 1.07.

Figure 1.03 (Top)
Welcome Garden
(University of Illinois Arboretum Website)

Figure 1.04 (Bottom)
Hartley Gardens & Core Allee
(University of Illinois Arboretum Website)

Figure 1.05
Idea Garden
(University of Illinois Arboretum Website)

Figure 1.06
Japan House and Gardens
(University of Illinois Arboretum Website)

Figure 1.07
Existing Core Arboretum Elements.

1.4 The Design for the Future Arboretum

This thesis seeks to use the ideas set forth in the Program Statement as well as the existing elements from the Master Plan that have been implemented on site to design the next phase of development for the arboretum. Many of the existing core elements remain in their current state in my proposed design for the arboretum, while additional elements discussed in the Program Statement that have not yet been implemented are studied and designed in greater detail as part of this project.

The proposed design takes into account the arboretum's current context within the larger university and local communities, the existing and potential new users of the site, and plans for future development of the university's south campus. Evaluation of these elements has led to modification of the eastern edge of the arboretum, which alters the boundary and character of the arboretum as a whole. The overall design for the arboretum that I have developed is influenced by theories of outdoor, environmental, and experiential education. I have also incorporated ideas and concepts learned through the study of precedents, including other arboreta, educational institutions, and literary works. I have developed a theory of planting design based on the integration of plant community characteristics with cultural and environmental influences. This theory is an organizational element throughout my design for the arboretum and is expressed primarily in the design of new arboretum elements, namely the Discovery Center, the Horticulture Collections, and the Habitats. Each of these elements and ideas are discussed in greater detail in later chapters of the thesis and are presented graphically in the final design drawing, shown in Figure 1.08. The final design is highlighted to illustrate spatial relationships between key arboretum elements in Figure 1.09. Ultimately, the final arboretum design is intended to be an extension of the design work previously done for the arboretum site that further emphasizes the unique potential of the arboretum as a destination for education and as an innovative demonstration of plant communities from both a cultural and an environmental perspective.

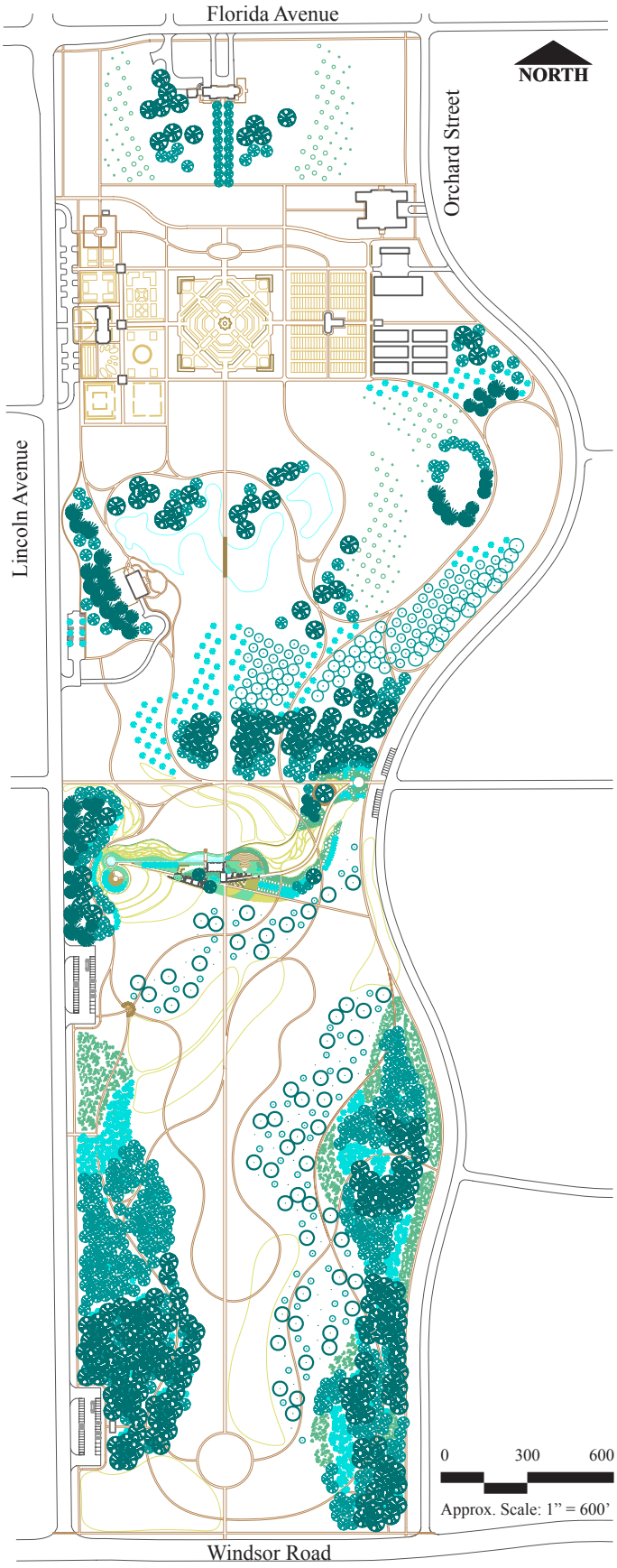

Figure 1.08
Final Arboretum Design.

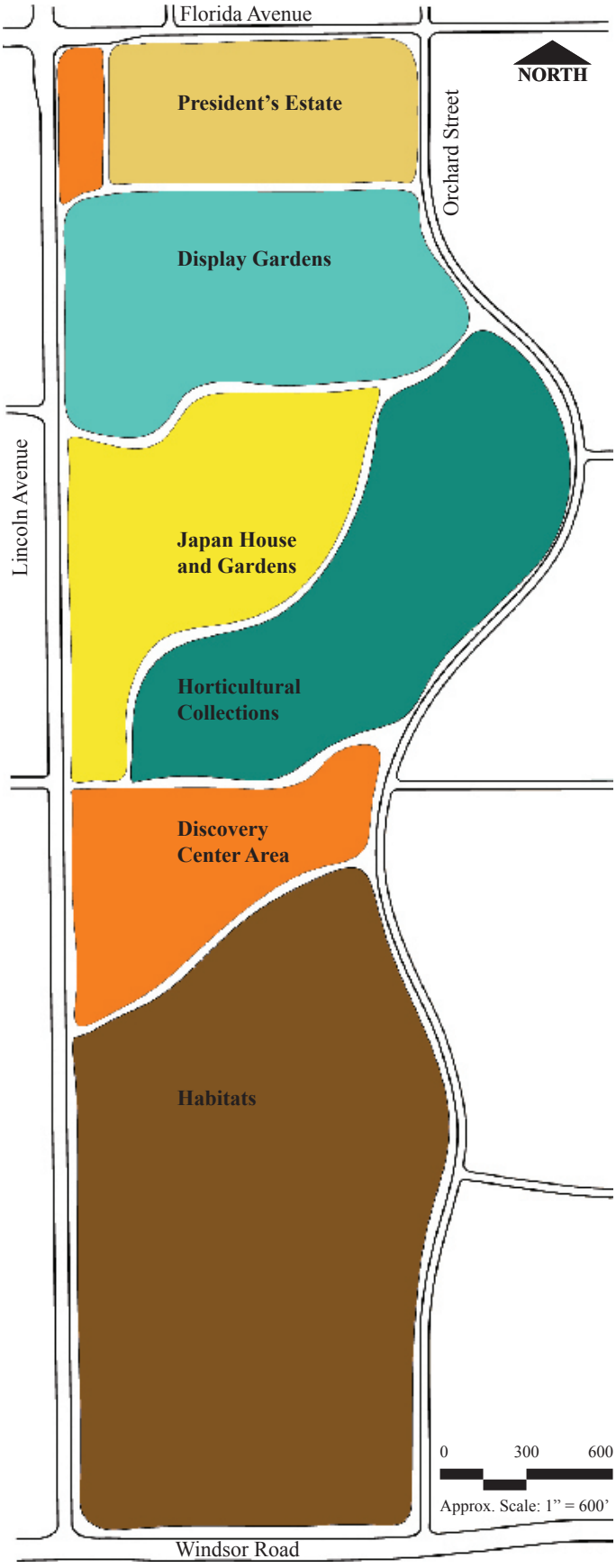

Figure 1.09
Arboretum Zones.

2.0 Understanding the University of Illinois Arboretum

In order to design for the future of the University of Illinois Arboretum it is necessary to understand how the arboretum currently functions as a university resource and as a neighborhood amenity, as well as necessary to evaluate the site characteristics of today's arboretum. This chapter examines critical site information and also provides a basic overview of elements of both the Arboretum Master Plan of 1993 and Arboretum Program Statement of 1997 that relate directly to this project, namely goals for visitation and outreach as well as the development of core arboretum elements. These topics are addressed in three parts: the Master Plan, Users and Uses, and Site Information.

2.1 Master Plan

A comprehensive Master Plan and Program Statement for the arboretum were developed in the 1990s in order to create a focus for future development of the arboretum. The Master Plan is a design for the 160-acre arboretum site that was a collaboration between the Campus Arboretum Committee, the University Office for Capital Programs, and Sasaki Associates, Inc. This design was based on the written Program Statement developed by the Arboretum Program Statement Committee which outlines in detail key elements and programmatic goals for the arboretum. The Master Plan identifies the distribution of spaces and core elements within the arboretum and depicts ideal relationships between these elements (See Figure 1.01). The Program Statement provides detailed information about proposed arboretum facilities, including the purpose, spatial requirements, and amenities to be included as part of each facility. The Program Statement also outlines the goals for the arboretum as a public resource for the university, the community, and the central Illinois region. Together, the Master Plan and Program Statement make up a comprehensive documentation package intended to direct future development and detailed design for individual areas within the arboretum.

The Program Statement outlines many facilities and displays that are potential aspects to be developed at the arboretum. The Core Elements, or critical elements, identified in the Program Statement are considered to be the Allee, Collections, Grand Hill, Hartley Gardens, Japan House, Landscape Horticulture Research Area, Natural Habitats, Ponds, Visitor Center, and the necessary supportive infrastructure. Numerous additional facilities are described as being part of the arboretum's future development, but are not considered Core Elements. Among these other facilities is the Discovery Center, which is described as "an essential outdoor classroom" (Nevling et al. 1997). The Program Statement for the arboretum outlines the following program for the Discovery Center:

> The Discovery Center will function as an outdoor laboratory for university courses that periodically require an instructional facility in the field. Programs at the Discovery Center will also include activities for school children, scouting groups, environmental organizations and other groups with outdoor instructional needs. In addition to its instructional uses, the Discovery Center will be used by arboretum visitors as a facility for rest and relaxation while using the southern end of the arboretum (Nevling et al. 1997).

While the purposes of a Discovery Center are identified, the spatial and structural requirements for the Discovery Center are not clearly defined within the arboretum's Program Statement. The definition of the Discovery Center could be interpreted as a singular site within the arboretum that acts as the center for educational activity, or it could be interpreted as an overall framework throughout the arboretum geared toward educational programming with multiple educational sites located throughout the arboretum. It is also open to interpretation as to whether the Discovery Center has an architectural component that provides space for indoor facilities or if it is strictly an outdoor entity within the arboretum.

For my thesis project, I have taken the concept of an outdoor classroom and expanded its meaning to not only include one individual educational space but also to encompass an educational design plan for the entire arboretum. By this definition,

the arboretum itself is the outdoor classroom that contains a variety of elements focusing on different educational aspects. The Discovery Center becomes the locus or hub of educational programming at the arboretum that provides visitor amenities and information directing educational visitation throughout the rest of the arboretum. The Discovery Center in this sense becomes one of the Core Elements in that it establishes coherence between other arboretum elements and facilitates the interchange of learning objectives throughout the arboretum.

The program for the Discovery Center will be largely based on the programmatic objectives of the arboretum. These objectives fall into five broad categories: teaching, research, conservation, public education, and enjoyment. The following is a list of functions from the 1997 Program Statement:

> • Teaching: To provide an outdoor laboratory for instruction and student research in both the plant sciences, design, and cultural arts and to serve as a vital resource of living materials for classroom use.
> • Research: To foster and encourage fundamental research with the plant collection; to demonstrate the feasibility and importance of new or existing arboricultural, horticultural, and silvicultural practices and approaches; and to promote research and study of the uses of the collection in the basic and applied plant sciences, design and applied arts, recreational and leisure studies.
> • Conservation: To collect and preserve the biologic and genetic diversity of native species; to study and interpret them as individuals and as members of larger natural ecological units; and to promote their conservation and use in the landscape.
> • Public Education: To facilitate cooperative interchange between private sector and public agencies by developing the Arboretum as a learning resource for the dissemination of knowledge and information about plants and their use in a cultural setting and value in our contemporary social fabric.
> • Enjoyment: To provide a unique place to visit, offering beauty, passive recreation, contemplative solitude, and a setting for educational and cultural activities that will instill state, community, and campus pride (Nevling et al. 1997).

The Discovery Center will effectively be the element within the arboretum that facilitates the interchange of these five objectives. A critical design element will be providing physical connections between areas of the arboretum that specifically focus on one of the five objectives such as the horticultural collections, the ecological habitats, and

the display gardens. The physical connections will provide opportunities to expand visitor experience through exposure to varied arboretum components and to enable the visitor to draw parallels between different parts of the arboretum.

Planning for these connections will additionally contribute to the overall cohesiveness of the arboretum. The current Program Statement and associated Master Plan consist of a general concept of four main elements: plant communities/habitats, collections/plots, gardens, and infrastructure. Infrastructure in this context refers to the formal design elements that direct visitor movement through the site. It is stated by the writers of the Program Statement that this arrangement "provides an outstanding hierarchical framework for teaching and learning. The framework is a progression from understanding functioning plant communities, identifying and displaying the plants that make up the community, and rearranging the plants in an aesthetically pleasing design" (Nevling et al. 1997). In the process of designing the Discovery Center and developing a plan for education throughout the arboretum, I will challenge the above statement by exploring other possibilities for creating "hierarchical framework(s) for teaching and learning."

2.2 Users and Uses

There are a variety of user groups to be considered in any design for the arboretum. The arboretum will serve as both a neighborhood amenity and a destination in and of itself; as a result there will be two types of users: frequent users and infrequent users. Frequent users include university faculty and students, residents in the nearby neighborhoods, visiting primary and secondary school groups, and local organizations. Infrequent users include non-locals visiting the arboretum as a destination in and of itself as well as visitors to Champaign-Urbana for independent purposes, such as business travel, vacation, and university functions, who include a trip to the arboretum as part of their travels. In designing the Discovery Center and associated educational framework throughout the arboretum I intend to focus on the similar and dissimilar needs of frequent and infrequent users in order to develop a design that satisfies the needs of both.

When considering the arboretum as a neighborhood amenity it is necessary to identify neighbors of the arboretum. Arboretum adjacencies include West Urbana, Orchard Downs, Florida Avenue and Pennsylvania Avenue Residence Halls, and Clark-Lindsey Village (See Figure 2.01). These areas consist of single-family housing, university certified apartment housing, undergraduate dormitory housing, and an assisted living community. Within the Urbana community the arboretum serves as a destination point, as a link between residential neighborhoods and the University of Illinois campus, and as part of a larger local green infrastructure and pedestrian circuit.

Ease of accessibility to the site and convenience of pedestrian circulation throughout the arboretum for daily use activities are of primary importance for frequent users. Additional factors to be considered when planning for arboretum use by infrequent users include the incorporation of amenities and facilities required for day-long activities. It is also necessary to design the arboretum in way that creates a distinct focus differentiating this site from similar institutions within a broader regional community.

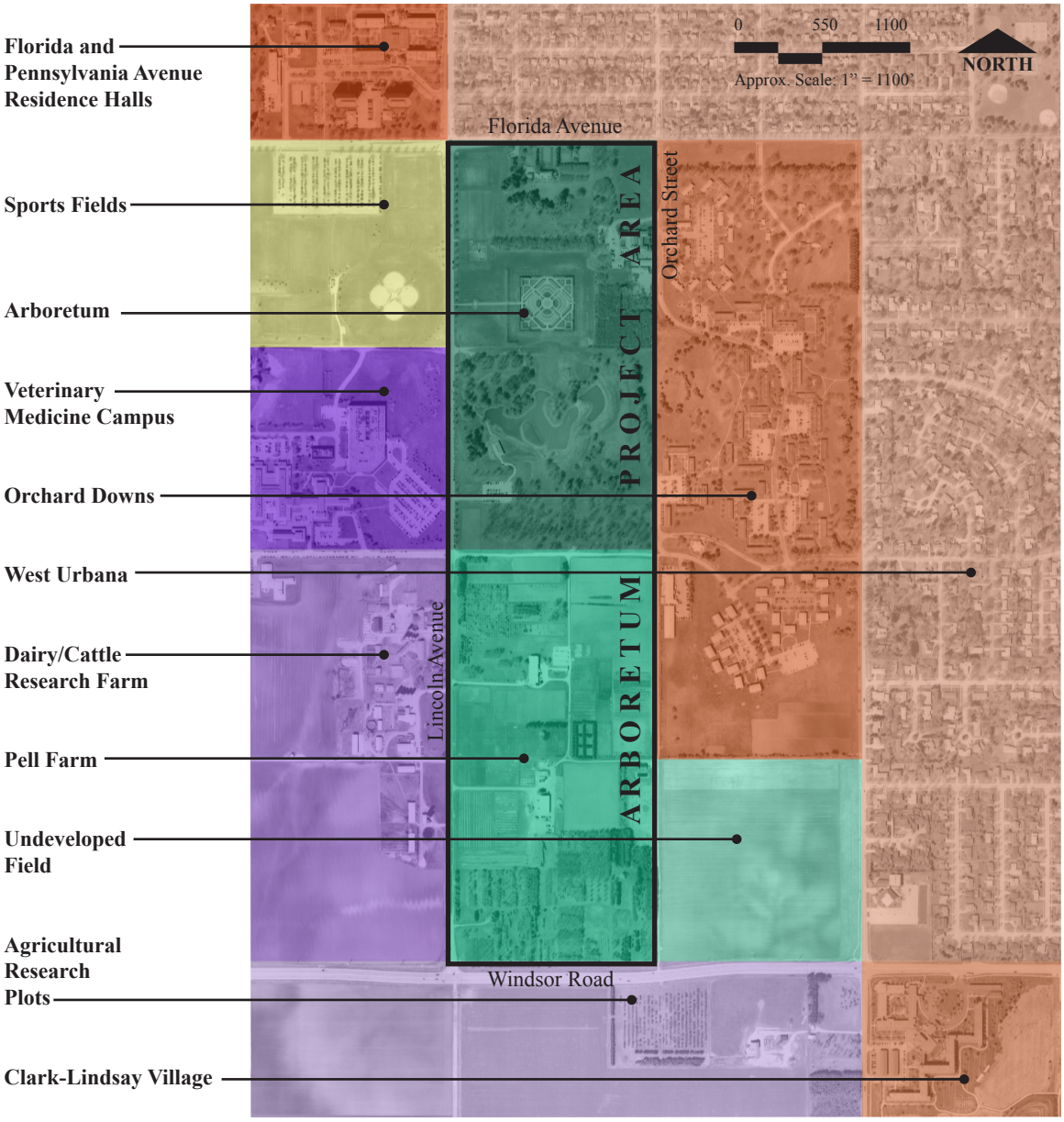

Figure 2.01
Existing Arboretum adjacencies.

Primary arboretum uses include environmental education, field studies, recreation, and leisure. Environmental education activities and field studies are most relevant for university users and student and community groups, whereas recreation and leisure are the primary activities relevant to neighborhood users. Environmental education activities are the focus of the Discovery Center at the arboretum and the primary "destination" draw for infrequent visitors. Field study opportunities at the arboretum include use of the collections to study individual plant specimens, examination of plant and animal communities within the ecological habitats, and analysis of the relationships between people and the environment throughout the arboretum. Applications for field studies at the arboretum include integration with university course curricula, faculty and student research, independent research, coordination with community outreach programs and collaborations with local organizations. In each case, be it environmental education, field studies, recreation, or leisure, the Discovery Center serves as a locus and source of arboretum information that further directs studies and activities throughout the arboretum.

2.3 Site Information

The goals of this section are to provide the reader with information regarding site conditions and context in order to become familiar with the arboretum property as it exists today and to begin to identify opportunities and constraints imposed by the site and its adjacencies. The information provided includes aerial imagery, topography analysis, soils composition, existing vehicular and pedestrian access, and proposals for future development of adjacent properties.

The boundaries of the arboretum site are Lincoln Avenue to the west, Florida Avenue to the north, Windsor Road to the south, and Orchard Downs to the east. The aerial image of the arboretum shown in Figure 2.02 shows current development and vegetative cover for the arboretum property and immediately adjacent areas. It is important to note that a few items from the arboretum master plan currently exist on site;

Figure 2.02
Aerial photograph 2003. Courtesy of the City of Urbana.

these are the Hartley Gardens, Grand Hill, Japan House, and Ponds. It is also important to note the location of the University President's Estate and the Nut Grove, as these elements remain in the redesign for the arboretum (See Figure 1.07).

The topography map shown in Figure 2.03 depicts two-foot contour lines overlaying the aerial image. The character of the topography is characterized as generally level to gently rolling with a few notable features, including the Grand Hill, the Ponds, and a central moderate ridge. The soils map shown in Figure 2.04 illustrates the six different soil types present on site and their properties regarding drainage and supported plant community types. A comparison of the topography map with the soils map indicates the spatial relationship between fill material and native Illinois soils and the associated elevations of each.

While existing site conditions are an important consideration in the design for the arboretum, it is also necessary to consider potential future development in areas close to the arboretum in order to fulfill the design goal of enhancing visitor connections and experience of the arboretum. The two areas that are likely to undergo significant change in the next five to ten years are the Orchard Downs area east of the arboretum and the South Campus area located immediately west of the arboretum and extending as far west as the research park at First Street.

A competition took place for the redesign of Orchard Downs in late 2006 and early 2007, while I was at the same time beginning my design project for the arboretum. The basic parameters for the competition were made public; the vision for the new neighborhood was to create "an intergenerational magnet neighborhood that will include a retirement community, upscale condominiums, parks and the UI's newly founded Osher Lifelong Learning Institute, a program for adults older than 50 years" (Forrest 2006). The major objection to this concept has been that it ignores the displacement of 1,500 university students. The importance of today's Orchard Downs is that it provides affordable graduate student housing designed for and marketed toward students with

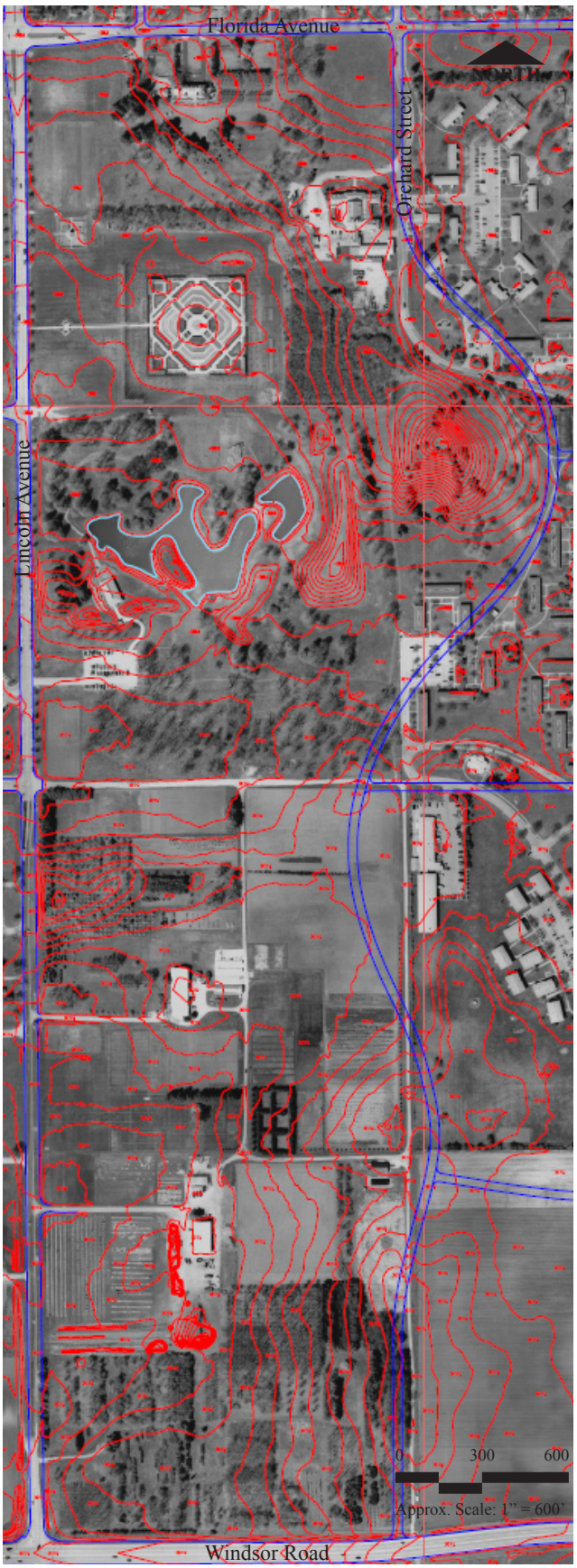

Figure 2.03
Topography with aerial image.

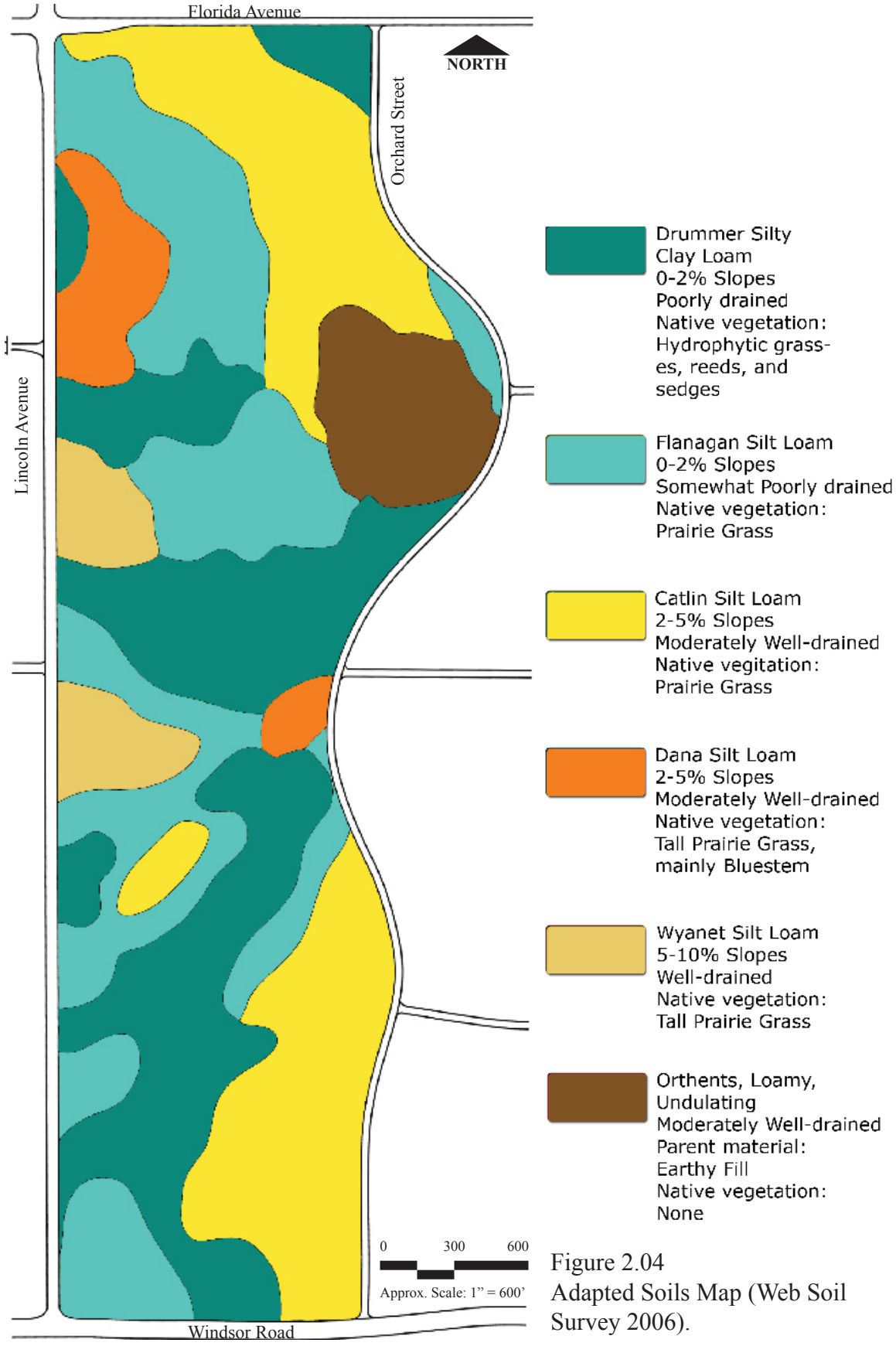

Figure 2.04
Adapted Soils Map (Web Soil Survey 2006).

families and international students. In the time since the competition took place, the project has changed direction slightly and remains in the developmental phase. The new plan for the area will include an "active senior retirement community, single housing units, as well as University of Illinois family student housing" (Herman 2008).

The arboretum has the potential to serve as the greenspace amenity for the proposed residential development, thereby creating the opportunity to develop a greater number of residential units in the Orchard Downs area. The treatment of the boundary between the arboretum and the residential neighborhood is an integral part of establishing connections between the two areas by creating a mutually beneficial arrangement that provides neighborhood greenspace and increases arboretum visitation.

The South Campus area is also in the early stages of redevelopment, however the direction that this development may take has not yet been determined. One proposal indicates the construction of a university golf course immediately west of Lincoln Avenue. Other proposals suggest the relocation of facilities within the college of ACES (Agriculture, Consumer and Environmental Sciences) and FAA (Fine and Applied Arts) to the same area. While the future usage of the area is unknown, the critical impact is that, as the campus facilities expand southward, the arboretum will gradually become a central element within the University rather than a peripheral element at the edge of campus. Design of the arboretum must anticipate future connections with its university neighbors to the west and also plan for the resulting increase in traffic and increase in visitation.

Additionally, the City of Urbana has in place a plan for development of greenways and trails as part of the city's Comprehensive Plan. Figure 2.05 shows the existing City of Urbana Greenways and Trails Classification Map. This map illustrates the locations of existing city parks and a plan for development of green corridors connecting these parks to create a system of greenways throughout Urbana. The arboretum functions as part of this system and as such connections to the Urbana greenways system are a vital part of the design for the arboretum; these connections are studied in more detail in Chapter 4.

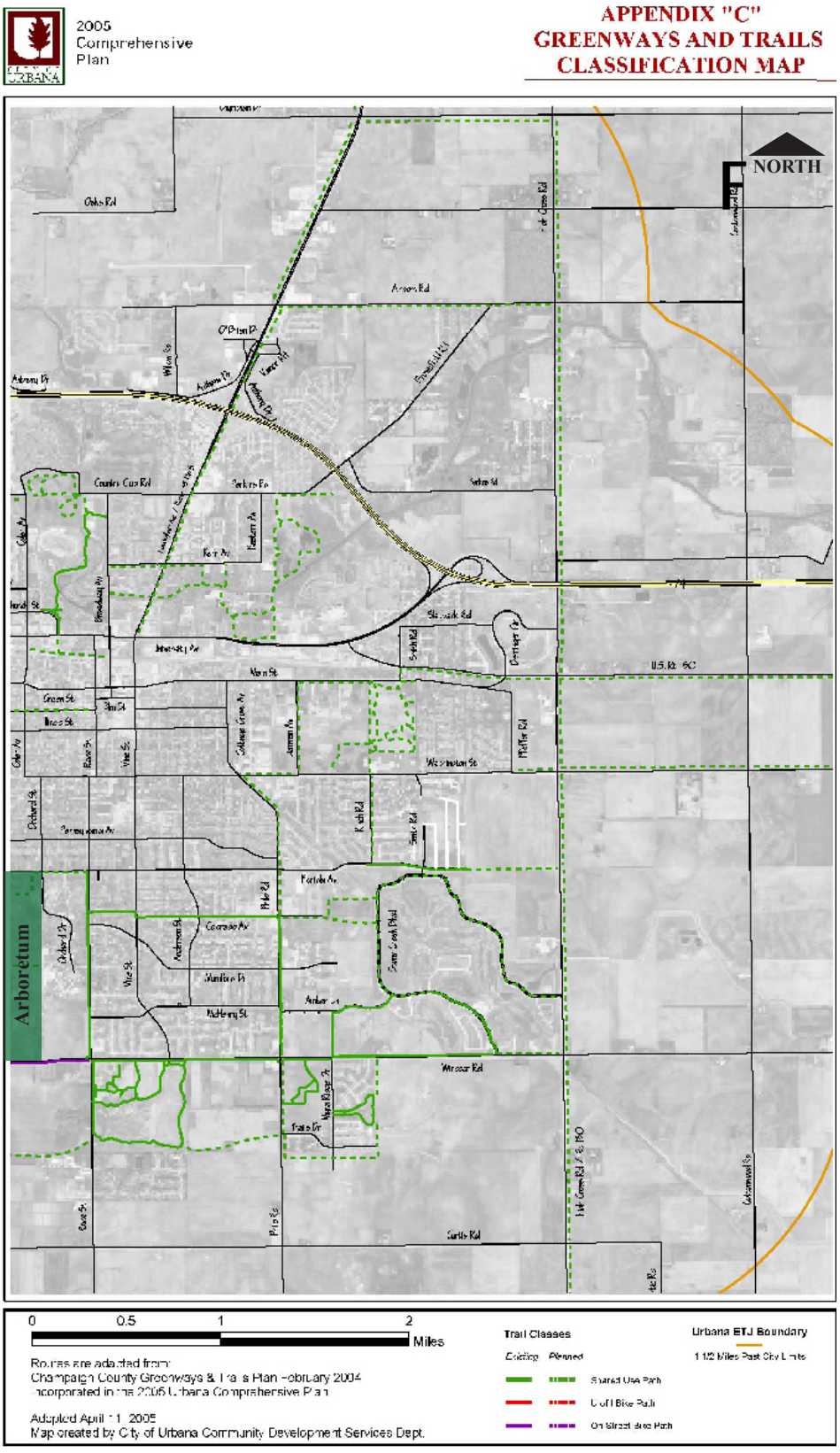

Figure 2.05
Off-site greenway connections.

3.0 Designing for Education at the University of Illinois Arboretum

An arboretum is a culturally-driven institution the purpose of which is to create an experience for people that provides information about plants. Arboretum designs range in scope from highly ornamental displays, to plant collections, to the construction of plant and animal habitats, and the conservation of natural areas. Arboreta have the potential to provide venues for educational experience about a wide range of topics relating to both ecology and landscape design. The design of an arboretum provides the unique opportunity for both the designer and the arboretum visitor to explore the relationship between two symbiotic communities—that of humans, and of plants.

The educational program outline for the University of Illinois Arboretum is based on three components: the educational goals to be integrated within the arboretum's design, the educational philosophies used as a basis for applying these goals, and the models or precedents studied as a reference for communicating these ideas in the landscape. Essentially these three components are the what, why, and how of the process employed in designing for education at the University of Illinois Arboretum. This chapter is arranged to give a brief overview of the educational goals and philosophies that have been employed in the design of the University of Illinois Arboretum, followed by their application in four areas of the arboretum and the precedent used in developing each area. The precedents include other arboreta, educational institutions, and a literary example.

3.1 Educational Goals

An arboretum, by definition, is a place for collections of plants for scientific, educational, or ornamental purposes. As such, the primary educational goal of the arboretum is to teach people about plants and display their aesthetic attributes. To accomplish this, I have developed four focus topics to direct the design of particular areas of the arboretum. These topics can be expanded through programming and visitor

usage to encompass a wide variety of educational purposes. The four focus topics are plant genetics and morphology, plant community development, expression of intrinsic plant characteristics, and the development of outdoor learning environments. Each of these subjects is the educational focus of a particular area of the arboretum but is also incorporated to varying extents throughout the arboretum. Arboretum zones are illustrated in Figure 3.01. The focus topic is demonstrated in each zone through planting design and is emphasized and explained through the use of interpretive landscape elements.

Table 3.1 Educational Focus Topics and Arboretum Focus Areas

Focus Topic	Focus Area
Plant Genetics and Morphology	Horticultural Collections
Plant Community Development	Habitats
Expression of Intrinsic Plant Characteristics	Discovery Center Area
Development of Outdoor Learning Environments	Entire Arboretum Site

Plant genetics and morphology is the horticultural topic traditionally addressed in an arboretum setting and relates directly to the research goals outlined in the Master Plan for the arboretum. The establishment of plant collections arranged taxonomically illustrates not only the genetic relationships between plants but also the historical significance of particular plant families as they co-evolved with human communities. Taxonomic groupings also show how genetic similarities are expressed morphologically in plants through plant growth patterns and plant tissue characteristics, which provide a straightforward venue for teaching about plant identification.[1] The horticultural collections are the focus area for the topic of plant genetics and morphology within the arboretum.

Plant community development relates directly to the goal of conservation addressed in the arboretum Master Plan. The establishment of ecologically influenced plant communities as well as culturally influenced plant communities within the arboretum is intended to stress the significance to humans of the maintenance of healthy

1 To learn more about plant taxonomy and morphology, see Michael A. Dirr, *Manual of Woody Landscape Plants* (Champaign: Stipes Publishing, 1998).

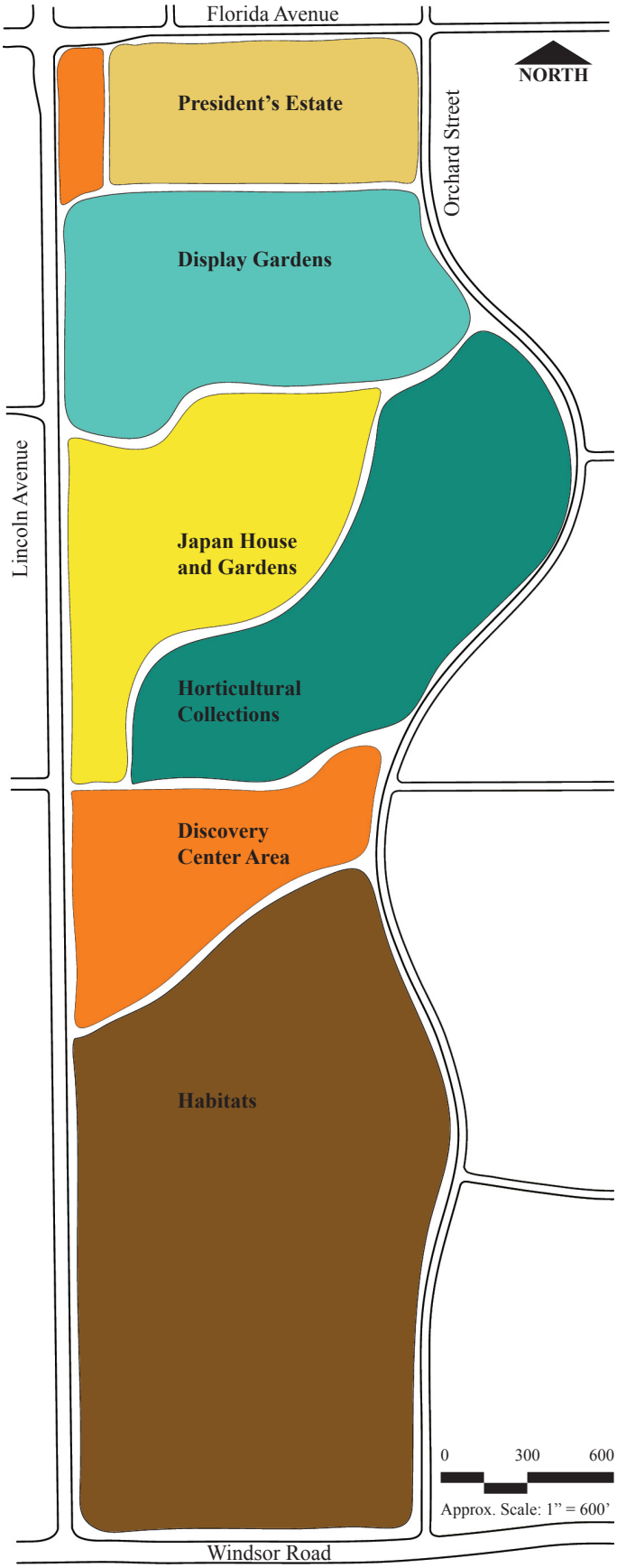

Figure 3.01
Arboretum zones.

plant communities as well as to illustrate the roles of both ecology and culture in the modern landscape. Four types of plant communities are expressed in the arboretum's design: woodland, savanna, shrubland, and grassland.[2] Variations within each community type are the basis for a theory of planting design discussed in detail in Chapter 4. The habitats zone is the focus area for the topic of plant community development from an interpretive standpoint.

The expression of intrinsic plant characteristics refers to the qualities of plants that contribute to the human sensory experience of landscape and relate most directly to the Master Plan goal of enjoyment. Plant intrinsic qualities can be categorized according to the human sense capable of perceiving them. Visual qualities include plant form, color, texture, and the interplay of light and shadow. Aural plant qualities are produced by the interaction of plant material with wind or other disturbance. Examples of these qualities are the sound of leaves rustling in the wind, the crunch of dried foliage in autumn underfoot, or the groan of a dead tree in the breeze. Olfactory qualities include both pleasant and unpleasant aromas produced by plant parts such as flowers, fruits, and foliage in their varying states of freshness and decay. Qualities of taste are experienced with the intentional incorporation of commonly known edible plants. Some examples of edible plants that are appropriate for the arboretum include persimmon, serviceberry, blackberry, blueberry, and apple. Tactile intrinsic qualities have to do with the surface texture of different plant parts. Experience of these qualities is achieved through the placement of plants in locations likely to come in casual contact with people as they pass by or locations that might cause people to reach out and touch them. The focus area for expression of intrinsic plant characteristics is the 10-acre Discovery Center site.

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2 To learn more about Illinois plant community types, see: Department of Biology, "Illinois Natural Areas Inventory Community Types," Southern Illinois University, http://www.plant.siu.edu/Invasives/Community%20types. See also: Illinois Department of Natural Resources, "Illinois Habitat Types," Illinois Department of Natural Resources, http://dnr.state.il.us.orep/c2000/guide/habitats.

The development of outdoor learning environments is integral to the achievement of the Master Plan goals of teaching and public education. Providing a wide range of learning environments that include different visitor amenities and accommodate individuals and groups of varying ages, abilities, and backgrounds significantly expands the educational potential of the arboretum. The thoughtful design of educational spaces that are both visitor-friendly and plant-friendly serves to facilitate human-plant interactions, thus further promoting the other educational goals outlined above. These factors are of primary consideration in the design of the educational framework throughout the entire arboretum site.

In order to successfully achieve the educational goals of plant genetics and morphology, plant community development, the expression of intrinsic plant characteristics, and the development of outdoor learning environments in the design of the arboretum, it is necessary to study the educational philosophies that are relevant to an arboretum setting. The following section outlines the basic concepts related to outdoor education, environmental education, and experiential education.

3.2 Educational Philosophies

In order to understand the potential of the arboretum as an educational institution it is necessary to explain three educational philosophies that are applicable to arboretum design. Outdoor education, environmental education, and experiential education are different philosophical approaches that, when combined, lead to a comprehensive learning experience in a field setting. As defined in the article “Outdoor, Experiential, and Environmental Education: Converging or Diverging Approaches?” outdoor education is a context for learning, experiential education is a method for learning, and environmental education focuses on the learning of core concepts and skills (Adkins and Simmons 2003).

Outdoor education refers to anything that is more effectively learned outdoors rather than indoors and is frequently associated with promoting wilderness experience. The concept of wilderness is constructed by humans; it describes places that have some degree of wildness or absence of human influence (Wilderdom 2006). Exposure to such places teaches people to consider the needs of non-human aspects of the environment. While the arboretum is influenced by human development in its design, there are aspects within the design that promote a wilderness experience and as such function as a destination for wilderness activities including team building, survival skills and orienteering, and field studies.

Experiential education on a basic level has to do with the notion of "learning by doing" and does not imply any particular setting (Adkins and Simmons 2003). In a broader sense, "experiential education is not just experiential learning, but also a philosophy of education that involves the interaction between learner and teacher and recognizes the larger system-level issues within education" (Journal of Experiential Education 1999). Experiential education challenges the notion that a well-rounded education can be achieved in a classroom setting and encourages alternative teaching methods. The arboretum is intended to serve as an extension of the classroom for specific topics that might be more effectively addressed in the field.

Environmental education is a field that promotes environmental stewardship by striving to establish an environmentally literate world population capable of acting in environmentally knowledgeable ways (Adkins and Simmons 2003). Environmental education can be approached on many scales; for example the United States Environmental Protection Agency promotes environmental education at a governmental scale whereas the Sierra Club promotes environmental education on the individual level (U.S. EPA 2006 and Sierra Club 2006). There are a number of local environmental education systems in place through the City of Urbana, the City of Champaign, the Champaign County Forest Preserve District, and independent organizations.

The arboretum at the University of Illinois has the potential to be a setting for outdoor, experiential and environmental education as well as a place to simply experience the outdoor environment. This project seeks to bring the arboretum closer to its educational goals through the facilitation of each of these three educational philosophies. The educational philosophies most effectively suited to communicating the focus topics outlined earlier in this chapter are applied to the design of each focus area within the arboretum.

3.3 Arboretum Applications

In this section, my intention is to show how the educational goals and philosophies discussed earlier in this chapter will be used in the design of specific areas of the arboretum. Four educational goals have been outlined, and for each goal I have also studied a specific precedent that effectively illustrates the application of the educational goal in an outdoor setting. These precedents are the Washington Park Arboretum, Pinecote at the Crosby Arboretum, The American Woodland Garden by Rick Darke, and A Studio in the Woods. I chose these precedents by first conducting preliminary research about numerous arboreta, botanical gardens, nature preserves, and other educational institutions. Of the institutions researched, I isolated these four examples as being the most relevant to the four educational goals established for the University of Illinois Arboretum.

The Washington Park Arboretum is used to show how an arboretum can be designed taxonomically to provide information about plant genetics and morphology, as well as how to communicate the educational goals to visitors of the arboretum through development of a wayfinding plan. Pinecote is a site at the Crosby Arboretum that has been developed according to the establishment of local plant community types and educates visitors about each plant community through the development of habitat journeys, or prescribed routes through the arboretum. The American Woodland Garden

by Rick Darke is a book that documents the seasonal evolution of specific sites with particular attention to the intrinsic aesthetic qualities of plants and ways in which design is used to create gardens inspired by habitat areas. A Studio in the Woods is an artists-in-residence community affiliated with Tulane University that exemplifies how educational goals can be facilitated through the thoughtful design of learning environments that integrate indoor and outdoor facilities, that are responsive to the natural environment, and that are flexible in function.

The following sections present each of the precedents individually. Each section describes the educational goal represented by the precedent, the area of the University of Illinois Arboretum where the goal is applied, and the educational philosophies relevant to the specific goal. Images and plans for the precedent sites are shown to highlight aspects of design employed at each site to achieve specific educational goals. Additionally, a preview of the way concepts inspired by each precedent will be applied to the design of areas within the University of Illinois Arboretum is discussed. These concepts are illustrated in greater detail in Chapter 5.

Goal 1: Provide information and research about plant genetics and morphology

Location: Horticultural Collections

Educational Philosophy: Outdoor and Experiential

Educational Model: Washington Park Arboretum

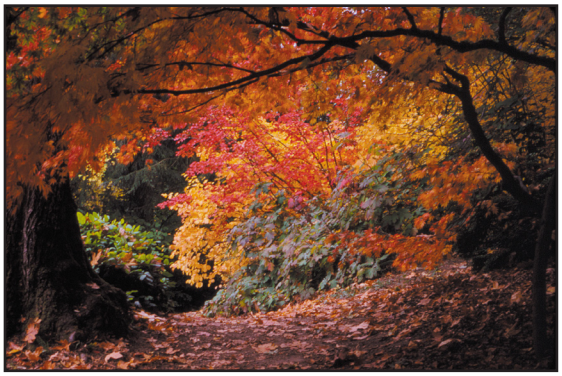

Figure 3.02
Autumn Woodland
© Arboretum Foundation/Joy Spurr (Arboretum Foundation).

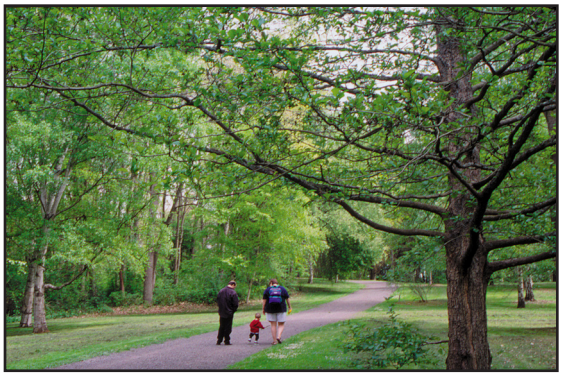

Figure 3.03
Summer Stroll
© Arboretum Foundation/Joy Spurr (Arboretum Foundation).

Figure 3.04
Woodland Garden
© Arboretum Foundation/Joy Spurr (Arboretum Foundation).

Figure 3.05
Winter Garden
© Arboretum Foundation/Joy Spurr (Arboretum Foundation).

Figure 3.06
Japanese Maple
© Arboretum Foundation/Joy Spurr (Arboretum Foundation).

In the design of an arboretum it is imperative that the long-term goals for the horticultural collections are established early in the development of the arboretum due to the length of time necessary for plants to develop into mature form and achieve the full potential of the collections. There are a number of ways to approach design of the collections, such as organization by taxonomic grouping or by geographical origin. In order to determine what approach is best, it is useful to answer the following questions: 1) What will be the organizational method throughout the collections and why is this method chosen? 2) What makes this organizational method unique and relevant to the specific arboretum in question? 3) How is the relevance of the collections arrangement communicated to visitors at the arboretum?

The Washington Park Arboretum in Seattle, Washington is an historic arboretum that has developed a plan for future development of the arboretum by evaluating their existing collections and addressing the questions above to direct further progress toward research and visitation goals. The analysis of the needs of a long-lived arboretum, such as the Washington Park Arboretum, is useful in a variety of ways in planning for the development of what is essentially a brand-new arboretum, such as the University of Illinois Arboretum. Namely, the new arboretum can pre-plan for the mature version of its collections by learning from the long-term development of the historical arboretum.

The Washington Park Arboretum Master Plan identifies three key reasons for the importance of maintaining horticultural collections: 1) education, both formal and informal, concerning the natural history and landscape value of woody plants; 2) conservation of plant species, and of their genetic diversity, that are threatened with extinction worldwide; and 3) effectively displaying the beauty, diversity, and landscape utility of temperate flora (Renewing the Washington Park Arboretum 2000). Currently, the Washington Park Arboretum has plant collections arranged taxonomically in order to communicate the concepts outlined above. The problem that has been identified with this arrangement is that the relevance of these groupings goes unrecognized by many of

the visitors to the arboretum. At the University of Illinois Arboretum, the horticultural collections will also be arranged taxonomically but for the purpose of communicating information about plant genetics and morphology. In order to increase the significance of this arrangement, the collections will be organized to correspond directly with the university's woody plant identification courses. This means that plant collections will be arranged alphabetically, first by family, then within each family by genus, and if possible also by species within each genus so that they may be used as a resource for the course. In order to reach a wider audience, additional interpretive information will be provided explaining what characteristics are indicators of plant genetic relationships. The intent is to direct visitors to look further and inspect the plants more closely so that they might learn the basis for the current system of plant taxonomy.

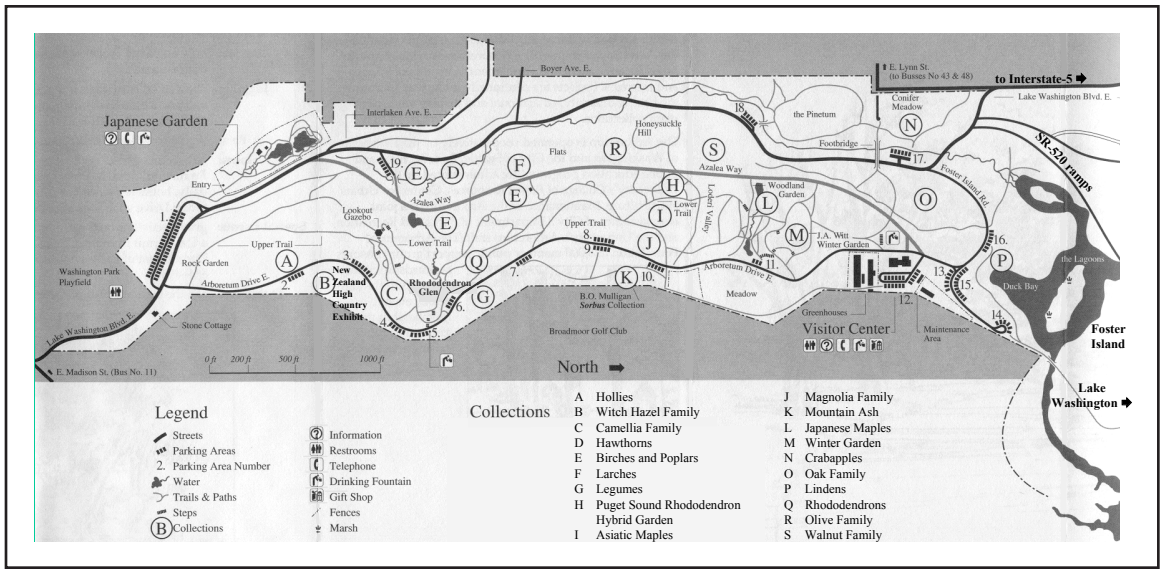

Figure 3.07
Washington Park Arboretum Trail Map (Washington Park Arboretum 2006).

In conjunction with the Master Plan, the Washington Park Arboretum has developed an extremely sophisticated wayfinding plan that provides details on how to enhance visitor experience and interpretation through the use of educational materials in the form of signs and printed materials. Signage in the horticultural collections will be geared toward plant identification and taxonomic relationships. Each plant will be tagged with its scientific name, plant accession number, and year planted. Each will also have a label either on the trunk or at its base that is readily visible with the scientific name, common name, and family name of the particular plant. Each family grouping will have an informational kiosk that outlines the features that are common to all plants in the family and identifies the location and appropriate season of specific plants in the collection where visitors can best see these attributes on display. Certain individual specimens near pathways will have larger information signs describing notable features of that plant relating to plant morphology and may have interesting plant facts. For example, a Sugar Maple information sign would state that the leaves are palmately lobed and explain this morphological term both textually and graphically. The sign may also describe opposite leaf arrangement with a close-up image of the plant's growth pattern. An interesting fact would mention the plant's role in the making of maple syrup and the time of year when maple sap is collected for syrup. While interpretive signage will be applied throughout the arboretum, the content related to taxonomy and genetics will be specific to the horticultural collections area.

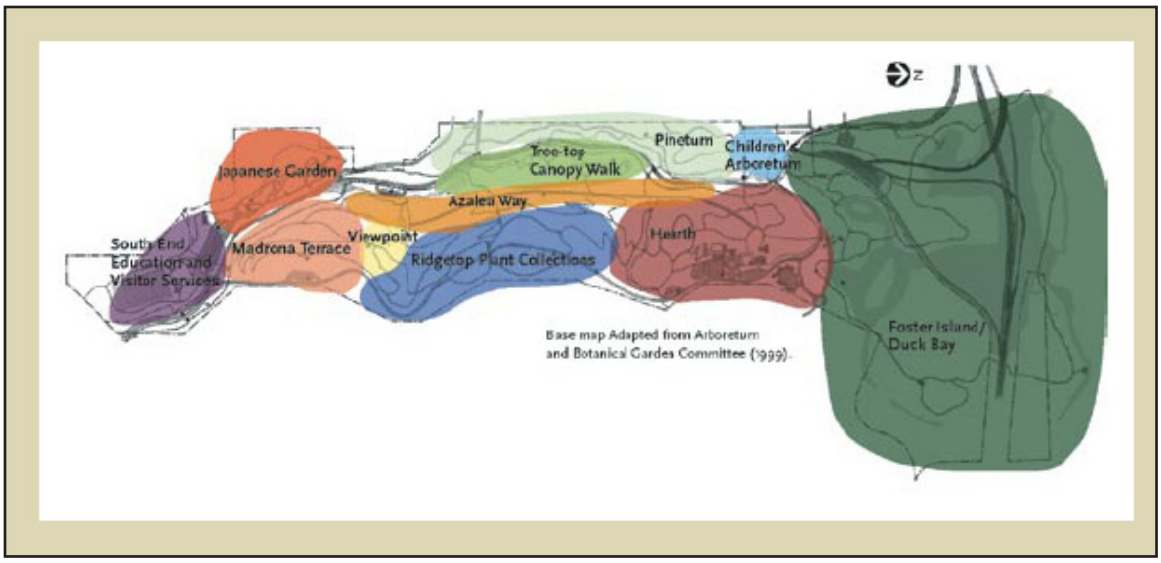

Figure 3.08
Washington Park Arboretum Interpretive Zones Map (Washington Park Arboretum Interpretive and Wayfinding Plan 2004).

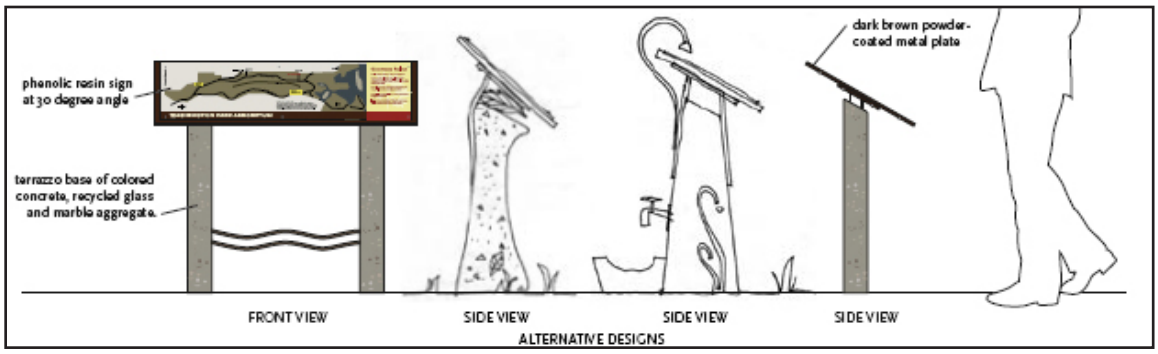

Figure 3.09
Pedestrian Orientation Panel (Washington Park Arboretum Interpretive and Wayfinding Plan 2004).

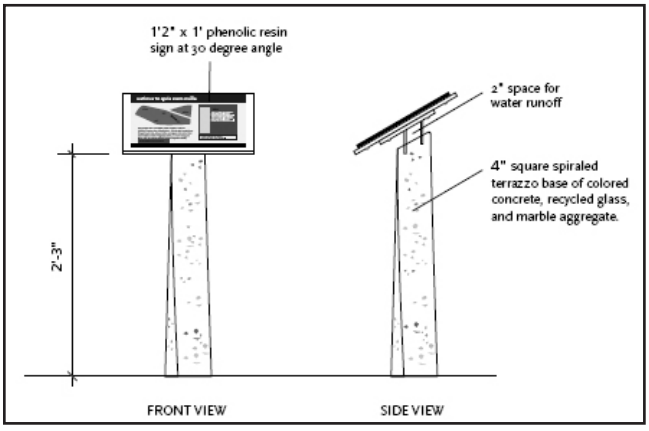

Figure 3.10
Freestanding Interpretation Panel (Washington Park Arboretum Interpretive and Wayfinding Plan 2004).

Goal 2: Teach about plant community development

Location: Habitats

Philosophy: Outdoor and Environmental

Model: Pinecote at the Crosby Arboretum

Figure 3.11
Piney woods lake with Pinecote pavilion at Crosby Arboretum
Photograph by Ed Blake (The Landscape Studio).

Figure 3.12
Wet savanna exhibit at Crosby Arboretum
Photograph by Ed Blake (The Landscape Studio).

Figure 3.13
Pitcher plant bog at Crosby Arboretum
Photograph by Ed Blake (The Landscape Studio).

Figure 3.14
Bog aerial moisture gradient color patterns at Crosby Arboretum
Photograph by Ed Blake (The Landscape Studio).

Figure 3.15
Pond reflections at Crosby Arboretum
Photograph by Ed Blake (The Landscape Studio).

Figure 3.16
View northwest across pond to Pinecote Pavilion at Crosby Arboretum
Photograph by Ed Blake (The Landscape Studio).

In my plan for the University of Illinois Arboretum, plant species interactions and plant community development are addressed in the habitats areas of the arboretum. The habitats are arranged to illustrate the sequence of succession between plant communities historically present in the central Illinois region. As such, savanna habitat is located spatially between prairie and woodland habitat because it is the successional stage that occurs temporally after prairie has waned and before woodland has become established. Shrubland is located as edge or pocket habitat because it is a successional opportunist that takes advantage of available resources wherever possible. This typically happens where light has become available within a woodland interior, or at the woodland's edge.

Individual plants are initially arranged within the plant habitats according to percentages present in native habitats. The idea is to set the stage, so to speak, for plants to compete for light, water, soil, and nutrients and develop associations leading to the establishment of plant communities specific to their location within the arboretum. The goal is for a dynamic system to develop where plant species travel by natural process (by seed or rhizome, for example) and become established and thrive in the precise location that is best suited for that particular species. Essentially, the designed habitat lays out the initial players and enables them to battle toward a variable but optimal result.

The Crosby Arboretum has developed one of its sites, called Pinecote, in Picayune, Mississippi as an interpretive center very similar in principle to the Discovery Center proposed for the University of Illinois arboretum. Pinecote has been developed to incorporate landscape exhibits that teach about native landscapes of the deep south, namely the freshwater wetland, savanna, and woodland. These exhibits are arranged according three ideas in the Master Plan for Pinecote: landscape patterns, landscape journeys, and landscape structures. In combination, these three concepts lead to a comprehensive visitor interpretive plan for Pinecote (Pinecote Master Plan 1994).

The concept of landscape journeys has had a significant influence on the arrangement of elements within the University of Illinois Arboretum. At Pinecote, there

are five main journeys: the arrival journey, the water journey, the woodland journey, the savanna journey, and the long journey. Each of these journeys has a distinct purpose. The arrival journey is essentially an introduction to Pinecote that in a short distance exposes visitors to each of the three landscape exhibits and connects the parking area with the orientation center, the visitor's center, and the beginnings of the other four journeys. The water journey, woodland journey, and savanna journey are similar in that each consists of a series of path loops that link different ecotones within their respective habitats. The long journey takes visitors through portions of each of the three habitat journeys and seeks to "explore how the components fit together and represent the co-evolution of humans and the land" (Pinecote Master Plan 1994).

The design of the habitat areas and pedestrian circulation patterns within the University of Illinois arboretum have been developed with the goal of establishing path loops and thematic journeys that enhance educational programming at the arboretum and tell a story about plant community development. The grassland, shrubland, savanna, and woodland journeys take visitors through different ecotones within each habitat. There are two path loops that expose visitors to a sample of each plant community; one is a short loop and one is a long loop to accommodate the abilities and interests of different visitors. Because many of the loops intersect, it is possible for the visitor to create their own journey by transitioning from one loop to another as they proceed through the habitat areas.

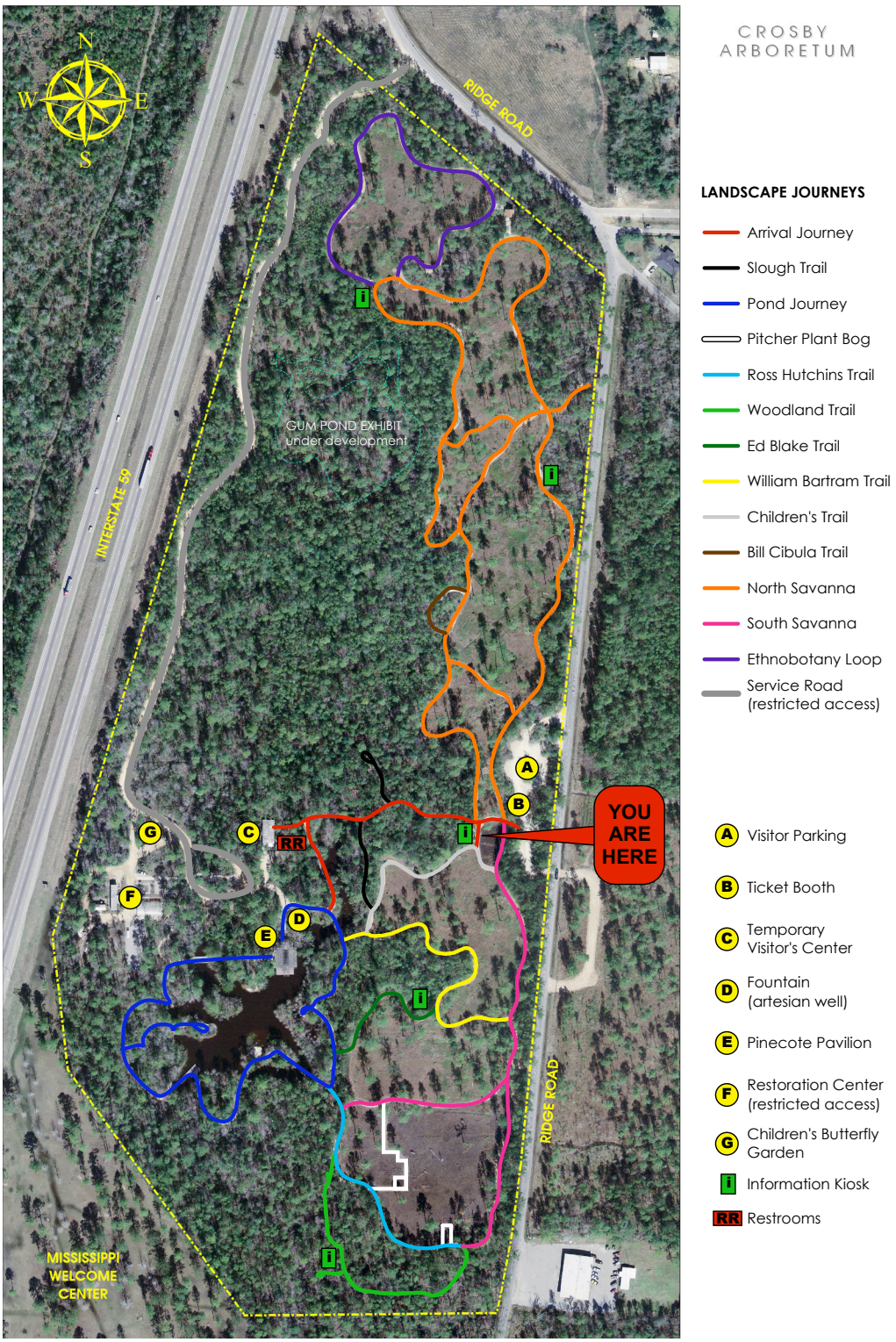

Figure 3.17
Crosby Arboretum Map Identifying Habitat Journeys (Crosby Arboretum).

Goal 3: Expression of Intrinsic Plant Characteristics

Location: Discovery Center Area

Philosophy: Outdoor and Experiential

Reference: The American Woodland Garden

Figure 3.18
Color in the Woodland Images
(Darke 2002).

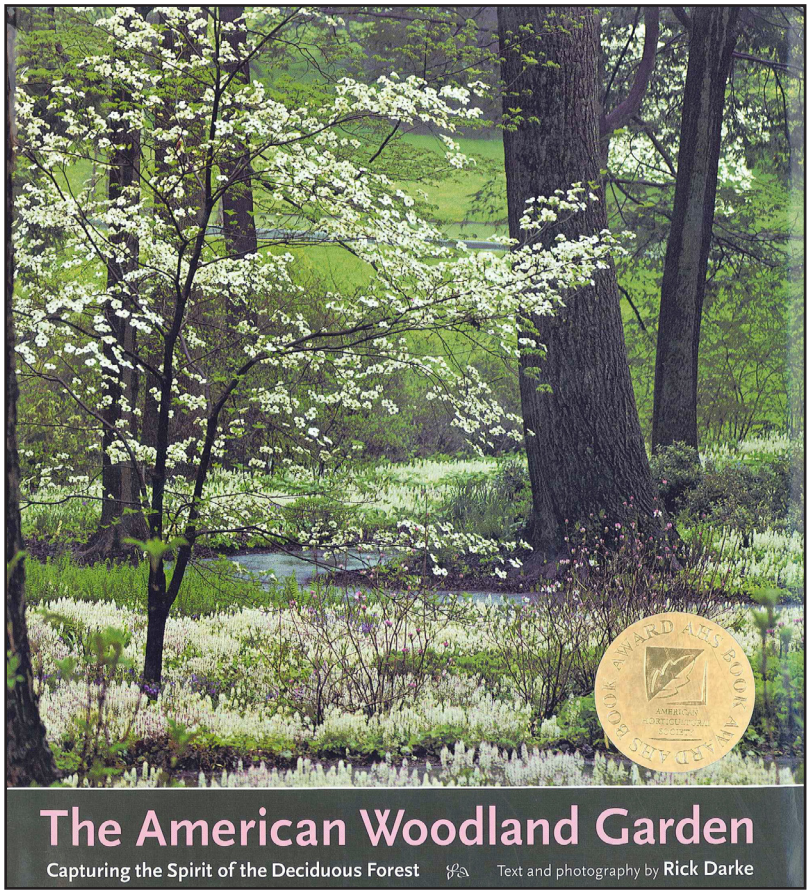

Figure 3.19
Front Cover, The American Woodland Garden
(Darke 2002).

In addition to teaching about the ways in which plants form communities by interacting together in a particular habitat, and teaching about the evolutionary relationships between plants, the planting design at the arboretum also seeks to highlight specific qualities of individual plants that are particularly delightful to people. The goal in doing this is to inspire in people an appreciation of plants and a sensitivity to the needs of non-human aspects of the human environment.

The inspiration for this educational focus comes from a publication rather than a location or institution. The American Woodland Garden by Rick Darke describes in detail the human pursuit of creating places that are inspired by nature and provides examples of how to distill the essence of a particular habitat in a garden setting. Darke explains numerous tactics for achieving this goal, but I have selected a few to focus on and employ in the planting design of the Discovery Center area. These tactics are: abstracting the forest (or other habitat), framing and enclosing, working with layers, encouraging natural form, and integrating exotics (Darke 2002).

Abstracting the forest means that, from a design standpoint, the designer isolates the essential characteristics of the forest to create a woodland aesthetic. The pocket gardens that link the three Discovery Center buildings have applied this tactic to create a woodland enclosure for the buildings. The pocket gardens are limited to a handful of species; a single tree species creates overhead canopy, a single groundcover punctuated by occasional herbaceous perennials establishes the ground layer, and ornamental understory trees create variation in texture and eye-level interest. Framing and enclosing is used to create spatial identity between different areas of the Discovery Center as well as increase visitor curiosity as they move through these areas. For example, the outdoor amphitheater is framed by pink flowering dogwood and enclosed by an evergreen screen. The east entry garden takes the concept of layering to an extreme by creating a vertically hierarchical corridor in what would otherwise be an exposed area. Encouraging natural form is actually applied throughout the Discovery Center area, meaning that plants are

not pruned into formal shapes and sizes; instead they are selectively hand pruned to maintain vigor without restricting growth patterns. The integration of exotics is evident in the grassland tiers that extend out into the savanna south of the outdoor theater and the parkland north of the outdoor theater. Colorful exotics have been included in these plant mixes to increase visual impact while maintaining the character of the grassland.

Darke also emphasizes the importance of developing intimate pathways where the smaller wonders of the habitat can be noticed and experienced, bringing the tactics of abstraction, framing and enclosing, plant layering, and the aesthetic characteristics of plants on an up-close-and-personal level to the visitor. This close contact enables a person to appreciate the finer sensory details discussed earlier in this chapter. An example of this sort of pathway runs east to west along the outdoor classroom's north edge to the outdoor theater. The narrow path is situated alongside an elevated planting bed with soft ornamental grasses that would brush against a person's arm as they pass by growing underneath flowering trees that emit a sweet fragrance in summer.

Figure 3.20
Example of abstracting the forest
(Darke 2002).

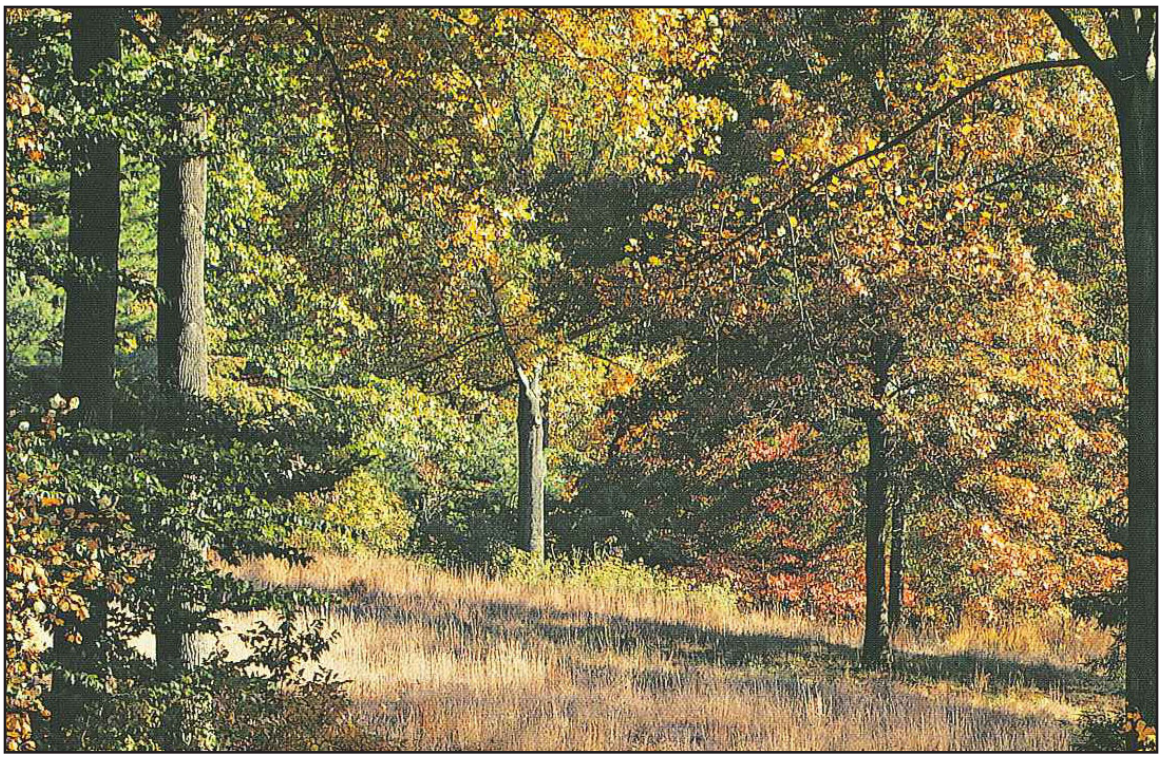

Figure 3.21
Example of framing and enclosing
(Darke 2002).

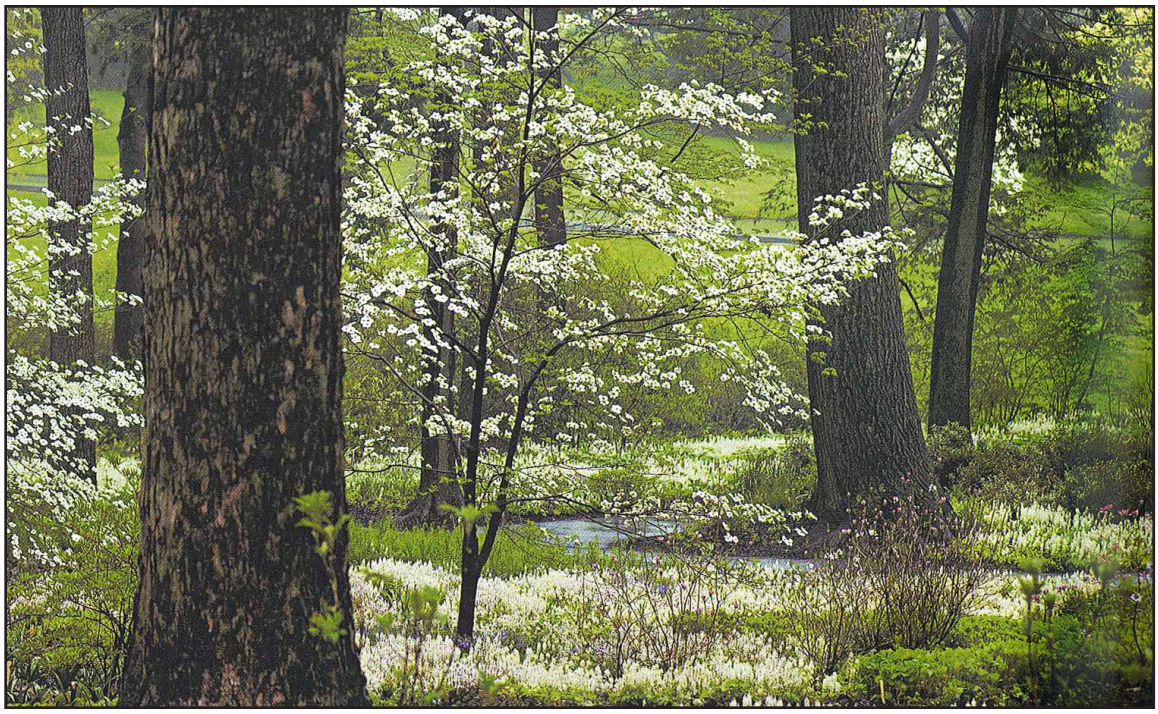

Figure 3.22
Example of working with layers
(Darke 2002).

Figure 3.23
Example of encouraging natural form
(Darke 2002).

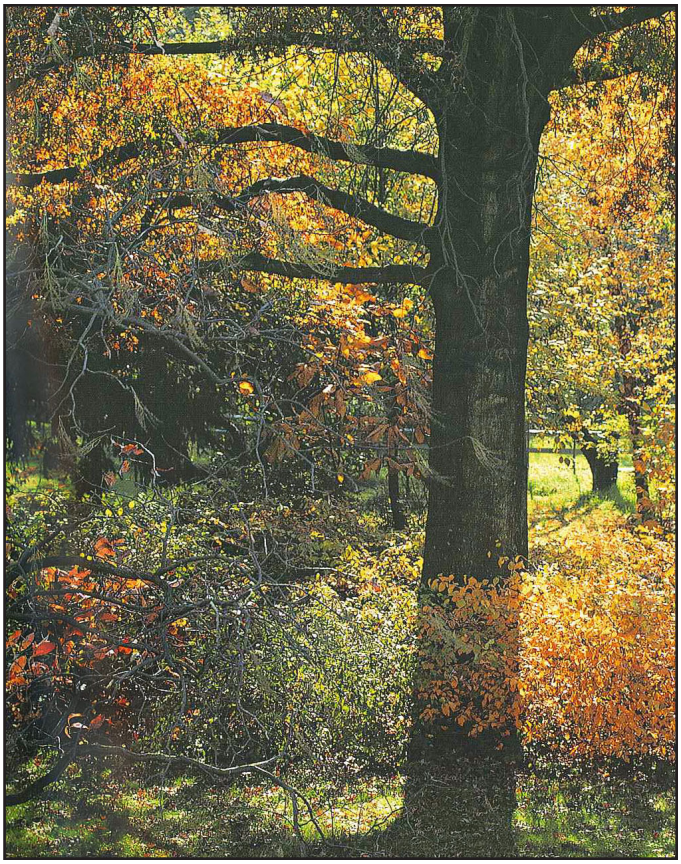

Figure 3.24
Example of integrating exotics
(Darke 2002).

Goal 4: Facilitate education through design of learning environments

Location: Entire Arboretum Site

Philosophy: Outdoor, Experiential, and Environmental

Model: A Studio in the Woods

Figure 3.25
Changing landscape residencies
(A Studio in the Woods).

Figure 3.27
Classroom retreats; learning from nature
(A Studio in the Woods).

Figure 3.28
Bottomland hardwood forest
(A Studio in the Woods).

Figure 3.26
Alternative learning environment 1
(A Studio in the Woods).

Figure 3.29
Alternative learning environment 2
(A Studio in the Woods).

A Studio in the Woods is an artists' community affiliated with Tulane University that is located in endangered bottomland hardwood forest along the Mississippi River in New Orleans. In 2003, A Studio in the Woods held a symposium to develop a master plan for future development of this unique living, learning, and teaching community (Winkert 2003). The resulting document from this symposium, A Studio in the Woods Conceptual Master Plan, provides useful information about how to develop educational spaces in a natural setting that connect people with the environment without harming the delicate ecosystem that they are inhabiting.

In order to reduce the Studio's footprint on the woodland, the plan for A Studio in the Woods integrates indoor and outdoor educational spaces in close proximity to each other and with flexible functionality, shown in the final plan in Figure 3.30. The plan designates community open space near these facilities for educational purposes, while distant natural areas remain primarily undisturbed, shown in Figure 3.31. The open spaces plan and intrusions into the woods plan (Figures 3.32 and 3.33) illustrate the location of boardwalks, allowing residents to have an up close experience of remote areas while preserving the bottomland forest, as well as the creation of surprise clearings in the woods for inspiration and education.

In developing the relationship between the Discovery Center and the educational framework for the University of Illinois arboretum, I used the Studio as a model for the design of the Discovery Center facilities and as a method for extending educational elements outward to other areas of the arboretum. The Discovery Center buildings discussed further in Chapters 4 and 5 seek to have functionally similar relationships between interior and exterior spaces that are exemplified in the plan for A Studio in the Woods. A series of pathways lead from the Discovery Center to remote areas of the arboretum where alternative educational spaces and interpretive elements that thematically relate to the Discovery Center are located, which is in a similar fashion to the intrusions into the woods concept exemplified at A Studio in the Woods.

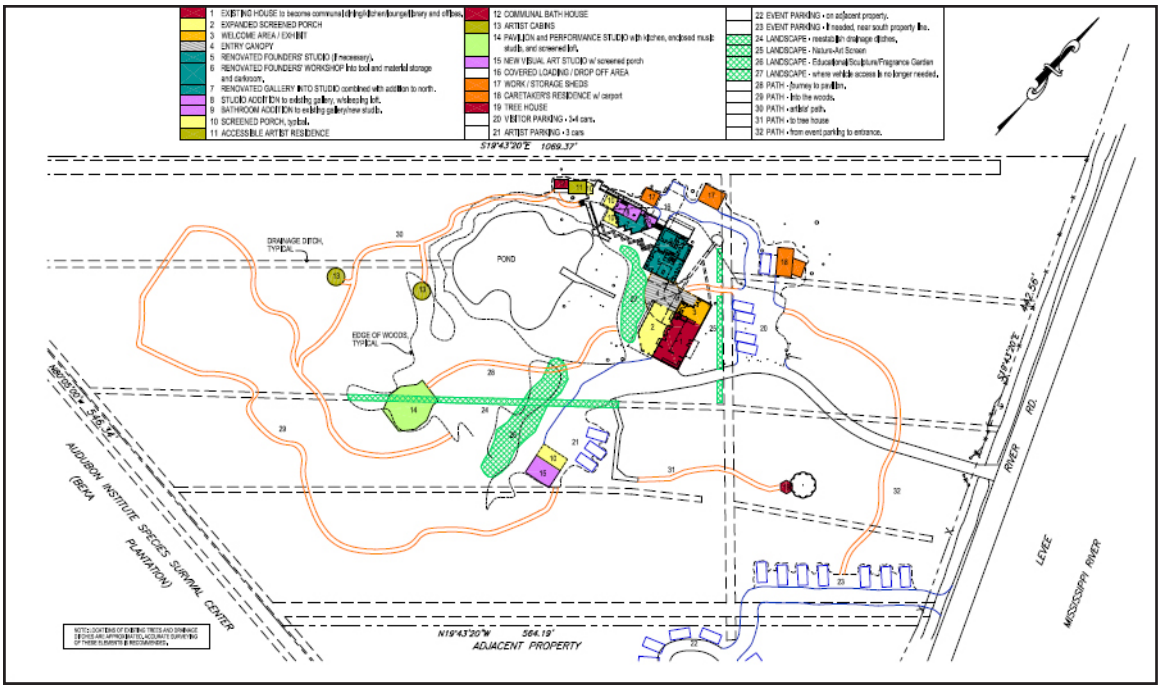

Figure 3.30
Final Site Plan (A Studio in the Woods Conceptual Master Plan 2003).

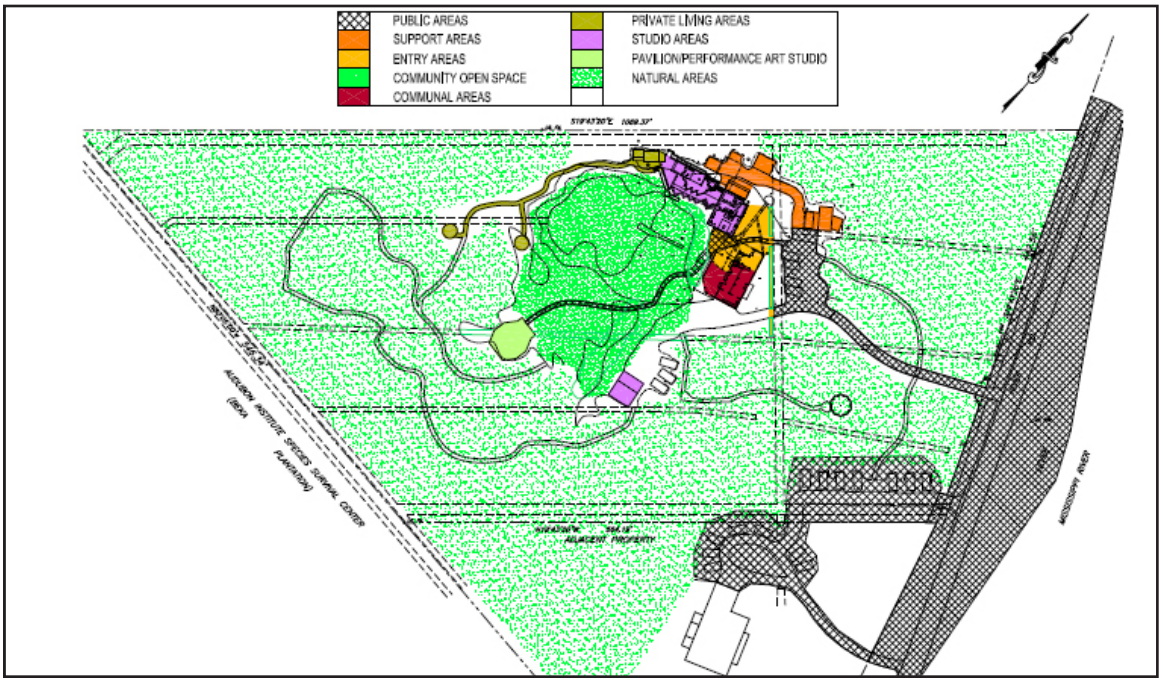

Figure 3.31
Site Zoning Plan (A Studio in the Woods Conceptual Master Plan 2003).

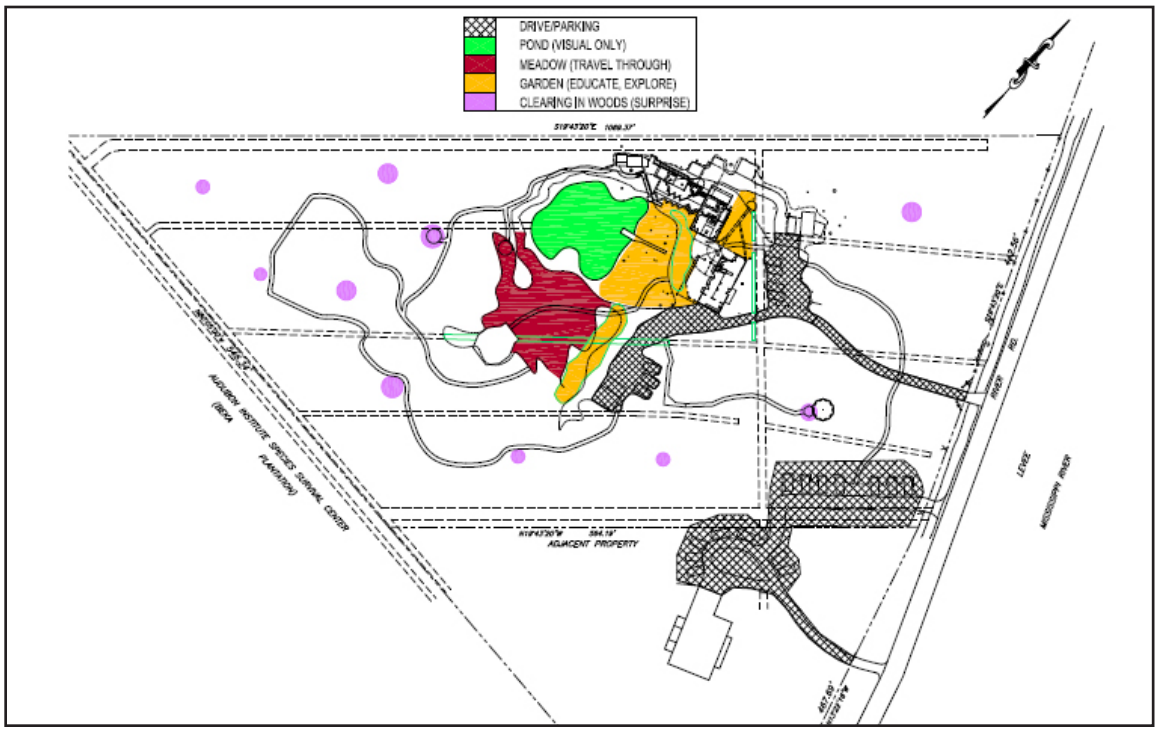

Figure 3.32
Open Spaces Plan (A Studio in the Woods Conceptual Master Plan 2003).

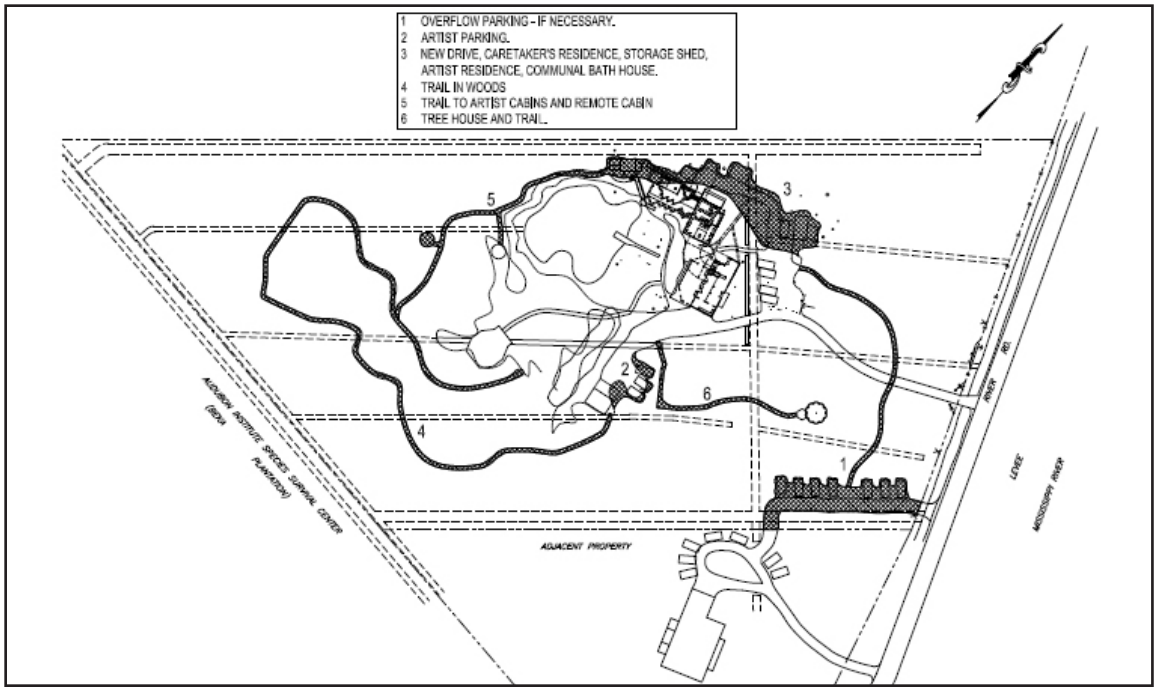

Figure 3.33
Intrusions Into the Woods Plan (A Studio in the Woods Conceptual Master Plan 2003).

3.4 Synthesis

Designing for education at the University of Illinois Arboretum is the culmination of the development of educational goals for the arboretum, the study of educational philosophies, and the examination of precedents that embody each of these educational goals and philosophies. The establishment of educational goals determines the content and organization of plant material throughout the arboretum. The analysis of outdoor, environmental, and experiential education provides a basis for the design of educational facilities, for the development of spatial relationships between visitor amenities, and for the development of conceptual relationships between different areas of the arboretum. The study of precedents informs the design of educational spaces throughout the arboretum through a comparison and evaluation of the varied ways in which site design is used at other arboreta and gardens to convey specific educational goals.

While developing educational goals for the arboretum, studying educational philosophies, and examining precedents of other educational institutions, I learned that there are two critical aspects of designing landscapes for education. The first, is to strive to create diverse experiences throughout the site that will entice visitors to continue to explore, learn, and grow with the arboretum through many seasons. The second, is to design with an understanding that not all educational experiences are programmed or pre-planned. Rather, the design of an educational landscape involves providing resources and amenities required for functional outdoor learning environments and developing the conceptual design with specific goals in mind, yet with flexibility for the site to continue to function optimally as the needs of the arboretum and its visitors change over time.

The information presented in this chapter is combined with site information presented in Chapter 2 as a basis for design of the educational framework and Discovery Center at the arboretum. The goal in the following chapters is to develop a plan that is uniquely suited to the arboretum site for the purpose of carrying out the programmatic goals for the arboretum presented thus far.

4.0 Design Process and Progression

The design for the arboretum began as a study of relevant community factors, an in-depth review of a few select outdoor educational facilities, and research about educational practices relevant to an arboretum setting. The design evolved into a study of the expression of form in landscape, a road development study, a spatial relationship analysis to determine the location of the Discovery Center, architectural research to discover building prototypes appropriate for the Discovery Center's indoor facility, and an expression of planting design philosophy. In this segment I intend to expose the reader to the evolution of the design as each influence was presented in order to reveal the process that led to the final project outcome.

Figure 4.01 "Jill Poet's Paper" (Paula Hayes 2004).

4.1 Expressions of Form in the Landscape

In the early stages of the design process I experimented with ways that the actual geometry of the design might have the potential to convey a message about the purpose of the arboretum to its visitors. I came across a publication of an exhibit at the Queens Museum of Art entitled *Down the Garden Path: The Artist's Garden After Modernism*.

One of the works struck me as being particularly relevant. This work is a drawing by Paula Hayes, “Jill Poet’s Paper,” shown in Figure 4.01. The drawing depicts a landscape plan graphic that uses the human form as the organizing element, and in my interpretation represents the human embodiment of nature. The image of the human profile inscribed on the land made a significant impression on me, and led to a succession of sketches that sought to inscribe the form of a tree over the arboretum plan. I found that the tree form, from roots to branches, had a very effective way of organizing circulation patterns throughout the arboretum as well as for subdividing areas of the arboretum for different purposes. Additionally, it brought to my attention the importance of nodes and internodes as a mode of spatial development within the arboretum. On the stem of a plant, a node is the point where a bud has formed and will produce the next stem, leaf, or flower. An internode is the space existing between each node. The overall form of the plant is structured by a series of nodes and internodes which create the branching-out or web pattern. This pattern can be applied to organizing spaces within the arboretum in that

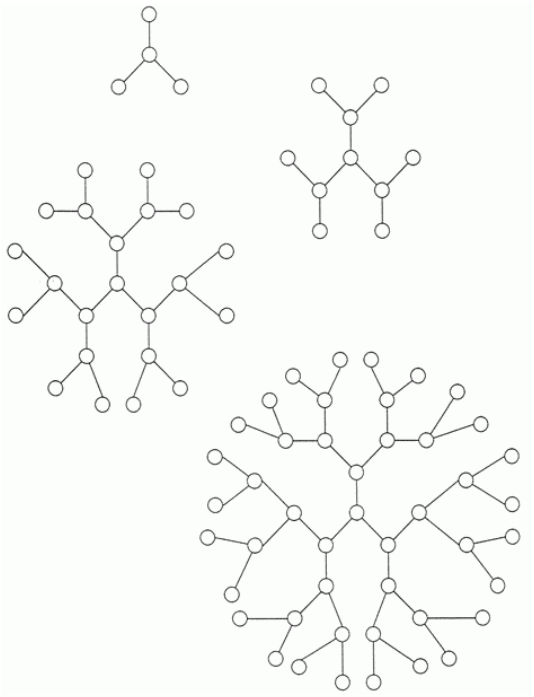

Figure 4.02 Node and Internode Diagram.

nodes become resting places or destination points and internodes are the paths connecting each point. Although the tree form was later abandoned as the geometry for the design of the arboretum, the series of nodes and internodes became a critical aspect of the pedestrian circulation development.

The tree sketch series began with a search for images of trees that highlighted the branching and/or root patterns. Once a few favorite tree images were selected, I scaled and stretched the images so that they might fit over the narrow rectangular property boundary of the arboretum. Next, I sketched a similar branching pattern onto the arboretum property, taking into consideration existing elements to remain as part of the arboretum plan, namely the Hartley Gardens and Japan House. This method yielded four basic tree sketches, shown in Figures 4.03 through 4.06.

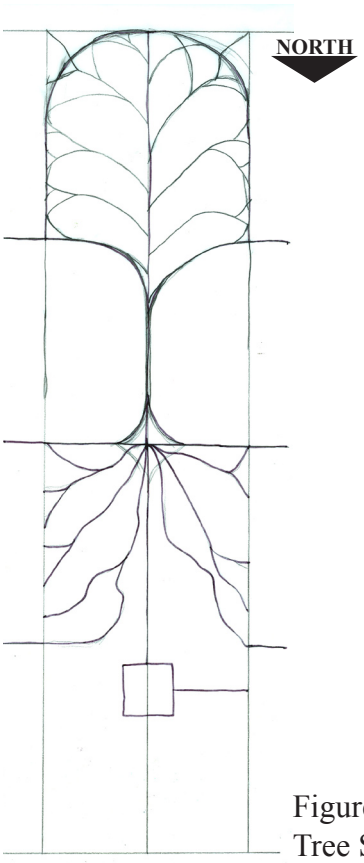

Figure 4.03
Tree Sketch One.

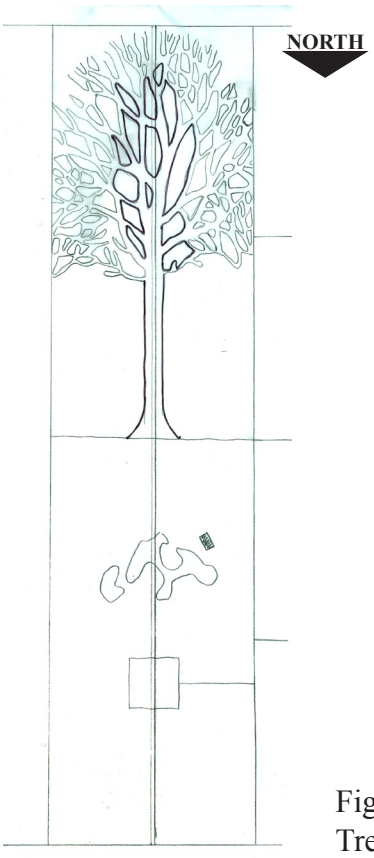

Figure 4.04
Tree Sketch Two.

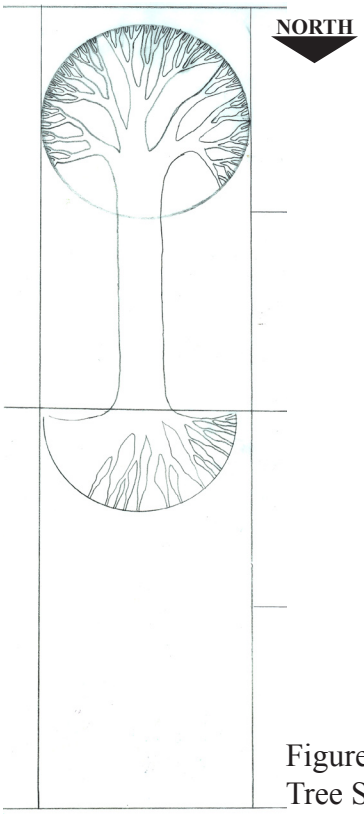

Figure 4.05
Tree Sketch Three.

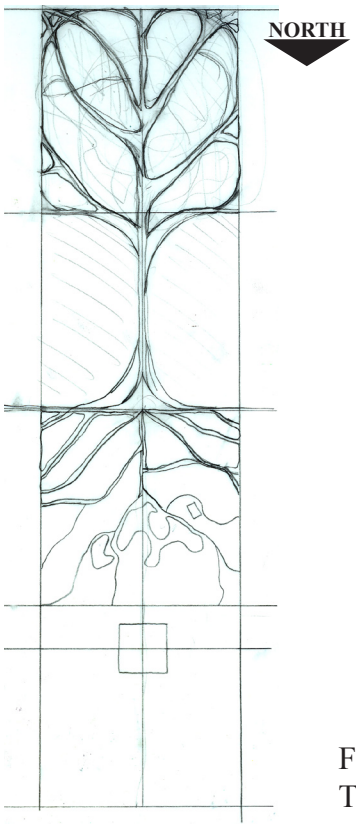

Figure 4.06
Tree Sketch Four.

The goal of these design concepts is to use the plan for the entire arboretum as one of the educational tools accessed by arboretum visitors. Although the form of a tree superimposed over the landscape at the scale of the entire arboretum would not be evident to visitors while they are traversing the space, it would be apparent through a variety of communication and marketing tools for the arboretum. For example, frequently the first thing that a visitor to the arboretum would look for is a sign or map to orient him or herself to their surroundings and the layout of the arboretum. This graphic tool would be repeatedly used and over time recognized as a representation of the arboretum itself. The tree form reiterates the purpose of the arboretum as an institution each time it is used.

From these four sketches, I selected one for further spatial analysis to begin determining points of access and identifying possible locations for the Discovery Center site. I determined access points by extending pathways from existing roads, buildings, and nearby greenspace. The paths selected are the most direct and most frequented routes

for entry into the arboretum. Figure 4.07 and 4.08 depict road extension as a thin blue line, greenway extensions as a thick green line, and potential Discovery Center locations as blue ovals. An overlay of spatial allocation for display gardens and habitat areas is depicted in Figure 4.09.

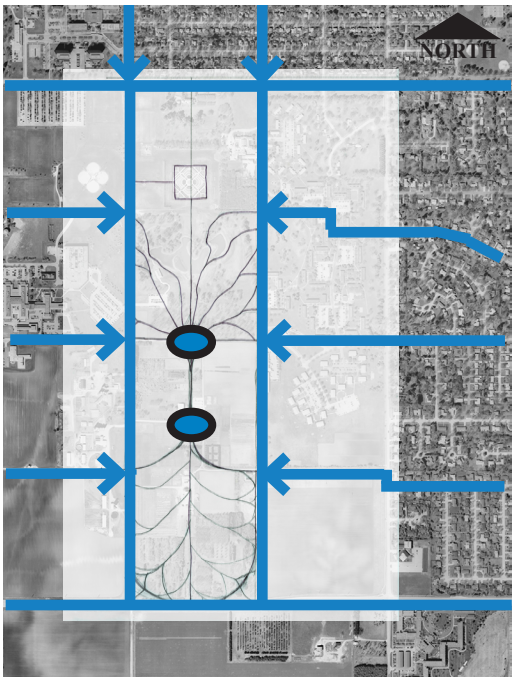

Figure 4.07
Points of Access and Discovery Center locations based on connections to existing roads and buildings.

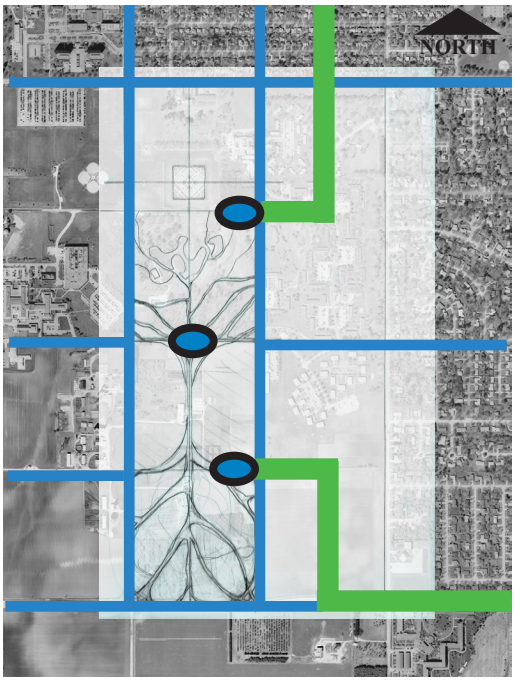

Figure 4.08
Points of Access and Discovery Center locations based on connections to nearby greenways.

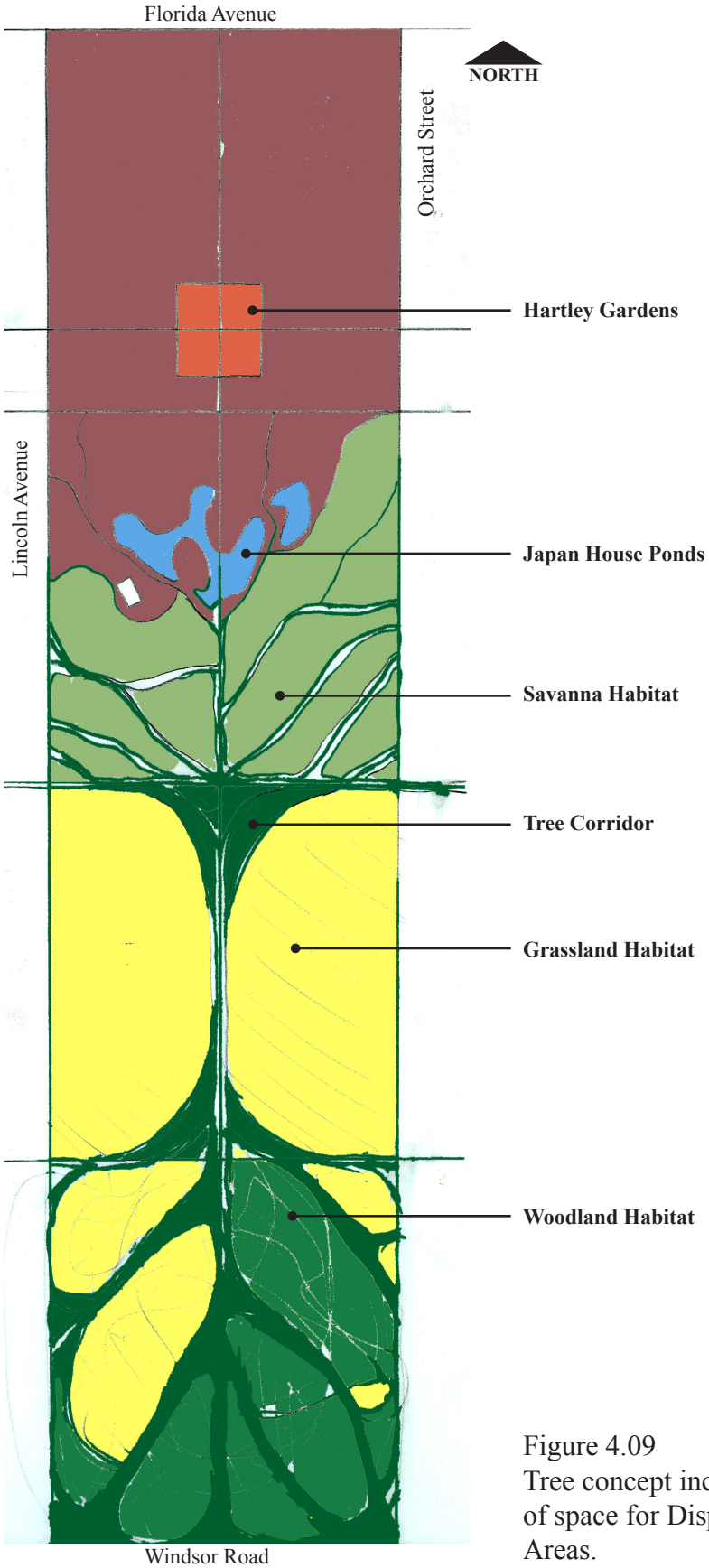

Figure 4.09
Tree concept incorporating distribution of space for Display Gardens and Habitat Areas.

4.2 Road Development Studies

After completion of the tree sketch exercise, I discovered that the irregular form of the trees I selected did not, in fact, fit well into a regular rectangular outline. At this time, a discussion arose as to how the arboretum might best interact with its neighbor to the east, the Orchard Downs graduate and family student housing community. Due to the fact that both the arboretum and Orchard Downs are university facilities, they are able to be modified to accommodate the needs of the other entity. Here is a case in point. The Grand Hill is technically located within the Orchard Downs community. However, since the main road bisecting Orchard Downs and the arboretum is curved around the base of the Grand Hill, it seems that the Hill is actually part of the arboretum. The Hill is currently used for arboretum functions, namely local and regional cross country events at the high school and collegiate level, and in the wintertime it is a popular sledding spot. This division of space and usage led to an informal understanding that in exchange for the care and maintenance of the Hill, the arboretum would receive rights to incorporate the Grand Hill within its boundaries.

This is an important point because while I was working on the arboretum design a competition was simultaneously in place to redevelop the entire Orchard Downs area to include mixed-use residential units. Rather than remain exclusively graduate-student and family-student housing, the future plans intend to include an assisted living community as well as single family residences and commercial businesses. Knowing that the entire property east of the arboretum was likely to change in the near future, the possibility of altering the arboretum's eastern boundary became open for evaluation. Because the competition designs were not available for public view I was therefore unable to work with one of the existing proposals as a basis for my redesign of the arboretum's eastern edge. Instead, I chose to experiment with possibilities for construction of a new road or roads between the arboretum and Orchard Downs that might provide optimal access to both places (See Figures 4.10 through 4.12).

The current road, Orchard Street, extends from Florida Avenue on the north and meanders southeastward about halfway to Windsor Road before dead-ending into a surface parking lot near a cluster of residential buildings. The benefit of this arrangement, since the residences are the primary destination along Orchard Street, is that traffic is light through the entire Orchard Downs community. One of my design goals in creating a new road between the arboretum and Orchard Downs is to create arboretum access points while maintaining pedestrian safety and the quiet aspect of a residential street. This intent benefits the arboretum by enhancing ease of access for local visitors who might arrive at the arboretum either on foot or by bicycle. Currently, the arboretum can only be accessed via Lincoln Avenue, a busy arterial street with heavy traffic, limited parking, and without sidewalks on the east side of the road. In addition to enhancing access to the arboretum, the new road benefits the new residential development by allowing for a spatial dialogue

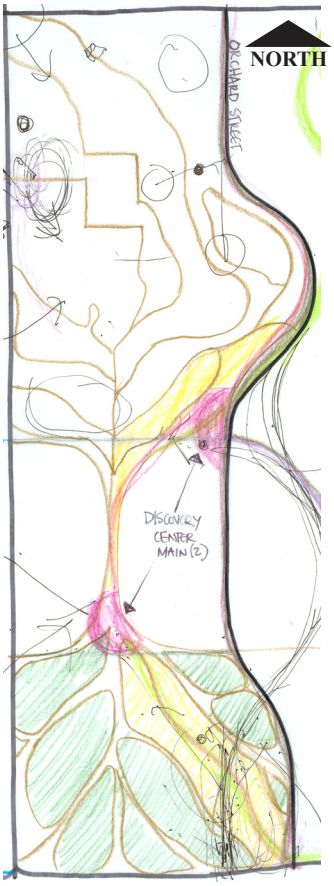

Figure 4.10
Tree + Road Sketch 1.

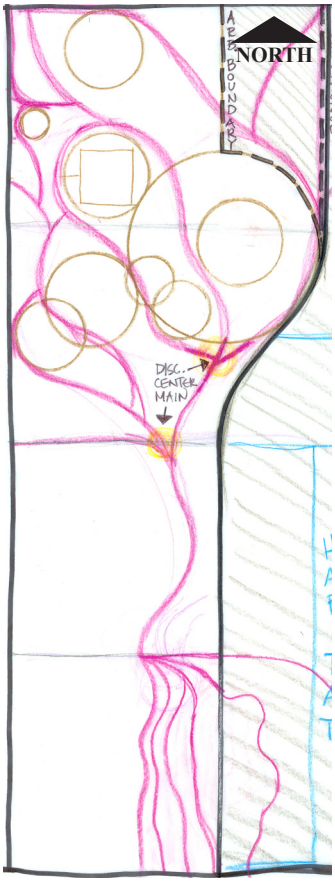

Figure 4.11
Tree + Road Sketch 2.

Figure 4.12
Tree + Road Sketch 3.

between the neighborhood and the arboretum, essentially making the arboretum a direct amenity to the residents both visually and physically.

Of the many possible road configurations I experimented with, the one that I finally settled on is a direct link between Florida Avenue and Windsor Road (See Figure 4.13). As a two-lane road with two main curves, the design speed is 25 mph, which is in keeping with the goal of maintaining a pedestrian- and neighborhood-friendly roadway. The road itself (along with its associated setbacks) becomes the boundary between the arboretum and the new adjacent residential community. The two curves have a give-and-take purpose: the road curves around the Grand Hill to include it within the arboretum and then curves west giving back an equivalent amount of property to the Orchard Downs neighborhood. The road itself is essentially centered evenly between the two properties.

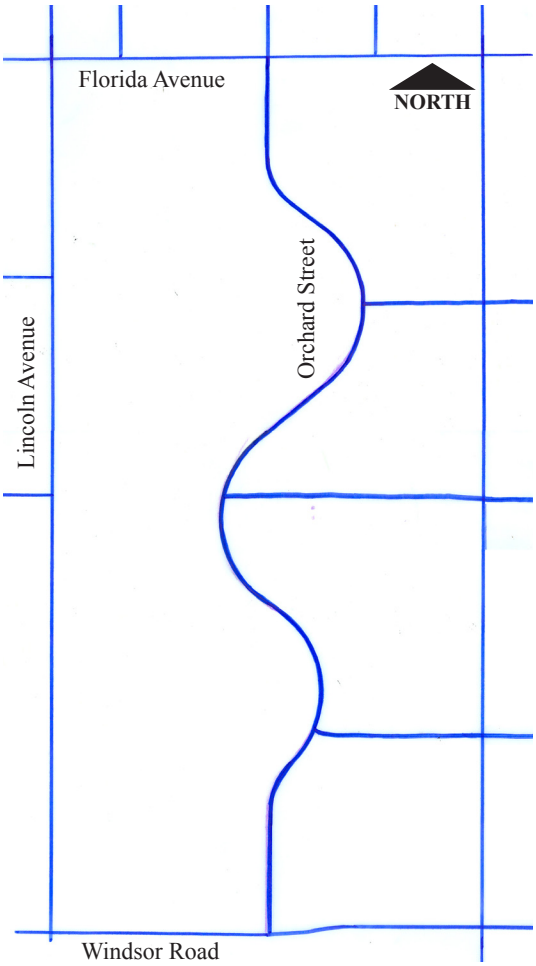

Figure 4.13 Final Road Sketch.

4.3 Determining the Discovery Center Location

Once I determined the eastern boundary of the arboretum, the next major objective was to determine the location of the Discovery Center area. The primary factors contributing to siting the Discovery Center are visibility, ease of vehicular and pedestrian access, and proximity to existing arboretum elements.

4.3.1 Visibility

In order for the Discovery Center to be easily recognizable and frequently visited it would need to be highly visible and easy to locate. The arboretum property, at first glance, is rather bland and at times monotonous. Taking advantage of the slightest topographic elevation, in my opinion, contributes to the visibility of the Discovery Center. There are two areas of relatively high elevation in the arboretum. The most prominent is the Grand Hill toward the arboretum's northeast corner. The second is a less obvious but reasonably significant ridge at the center of the arboretum running from north to south and extending east from Lincoln Avenue. While the Hill occupies a higher standpoint within the arboretum, I chose the ridge as the location for the Discovery Center for reasons of access and proximity - two points that I will discuss in the next section (See Figure 4.14 and Figure 4.15).

4.3.2 Vehicular and Pedestrian Access

By locating the Discovery Center on the ridge, I was able to take advantage of not only its elevation, but also its proximity to Lincoln Avenue. One critical access issue for the arboretum as an educational institution is to provide adequate entrance for groups of all sizes. Currently, if a large group were to arrive at the arboretum by bus, the driver's only option would be to pull over on the side of Lincoln Avenue, an overcrowded two-lane arterial road with parallel meter parking on either side at the north end, and then to unload at the curb onto a parkway with no sidewalk. Providing a loading, unloading, and

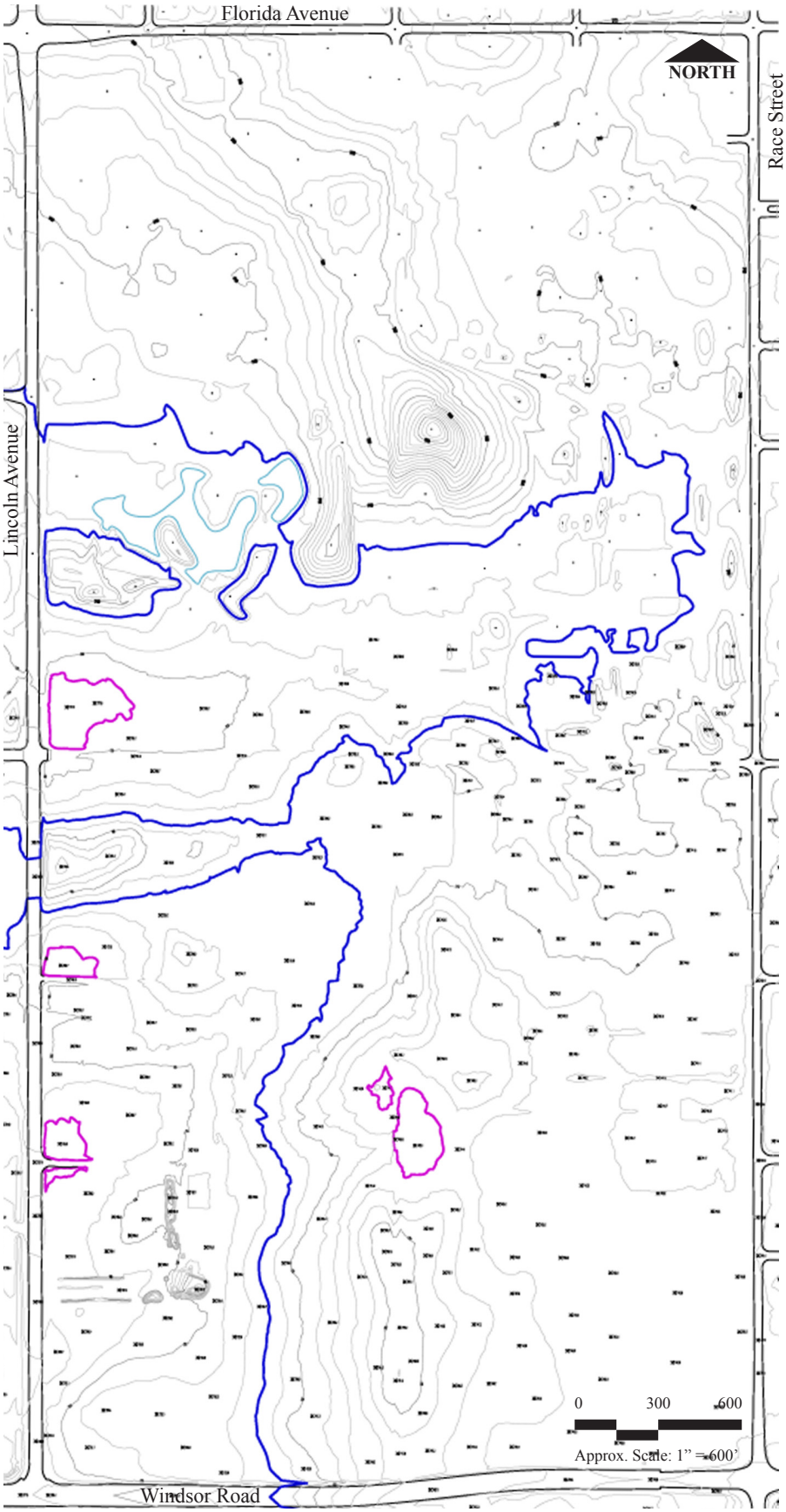

Figure 4.14
Contour map highlighting ridge detail.

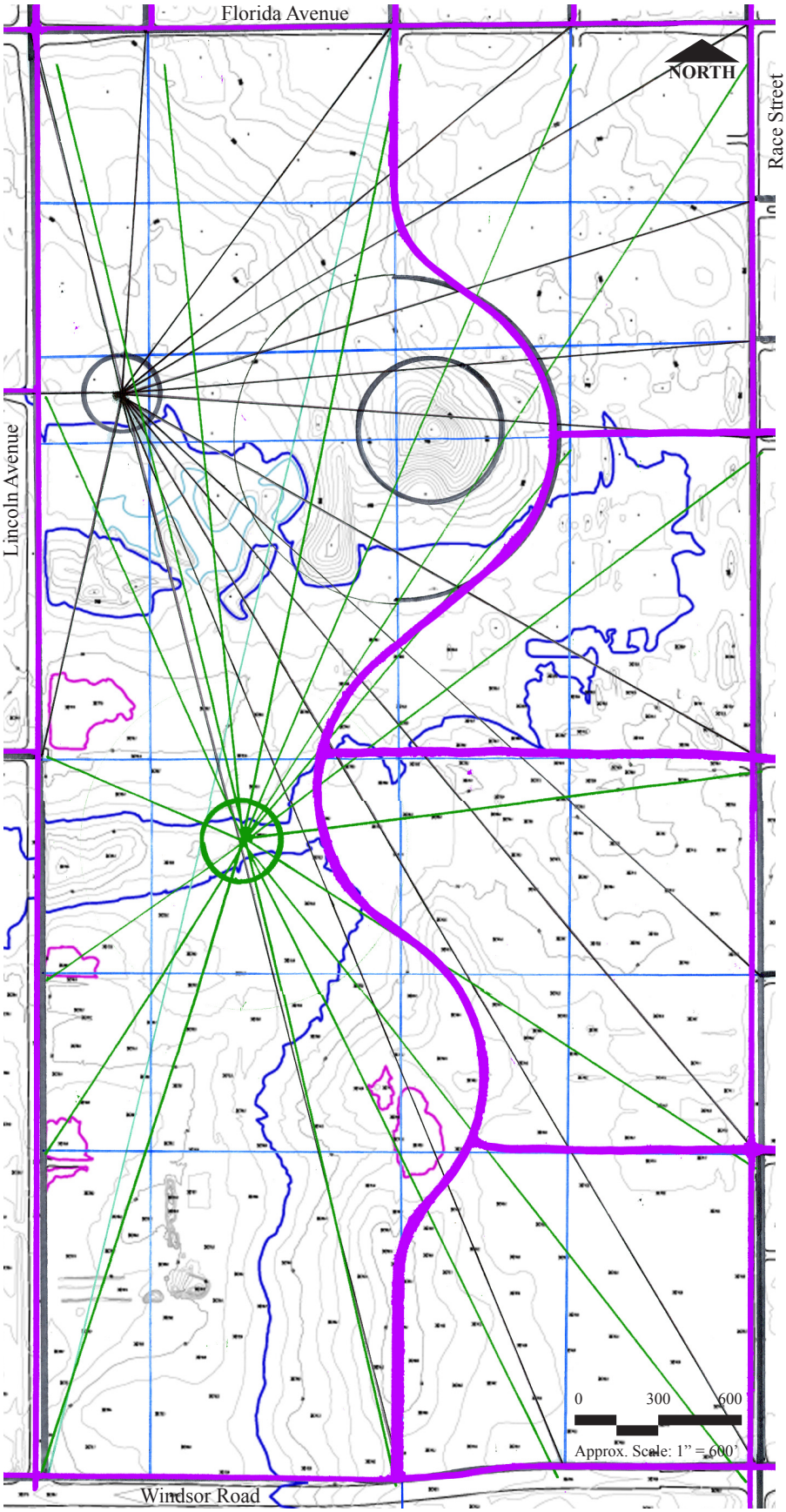

Figure 4.15
Contour map with road and site line overlay.

parking area for buses would only be possible along Lincoln Avenue and not on the new Orchard Street. A Discovery Center location near the bus loading zone provides a great convenience for large groups of visitors.

The majority of the arboretum's visitors will likely arrive by car. Therefore, adequate parking in appropriate locations will be a necessity. Rather than follow the existing method of paving one large space that is distant from any major point of entry, I have chosen to create many points of entry, each equipped with a small parking area. This method caters to repeat visitors, who may acquire favorite spots within the arboretum and choose to park near those locations. It also accommodates visitors coming to the arboretum for a specific event or purpose; it provides nearby access to bring in materials, refreshments, or any other equipment necessary for a particular program.

Additionally, part of the design program is to provide non-vehicular access from all around the arboretum, including creating a path for both cyclists and pedestrians running north-south from Florida Avenue to Windsor Avenue. A network of pathways throughout the arboretum seeks to draw visitors into the arboretum from the road as well as create a series of experiences within the arboretum from one area to the next.

4.3.3 Proximity to Arboretum Elements

The existing arboretum Master Plan design suggests that all visitor amenities, including a visitor's center, display gardens, educational facilities, greenhouses, etc. should be clustered together at the north end of the arboretum. While this arrangement has the potential to create an incredibly dynamic experience at the north end of the arboretum, it is my opinion that it fails to address the majority of the property as a place for visitation. By siting the Discovery Center at the center of the property, visitors will be drawn into the heart of the arboretum. The center of the arboretum is also a logical place for the Discovery Center because it has relevance to both the garden areas and the habitat areas. Both areas have educational aspects depending on the user group. Ideally, the

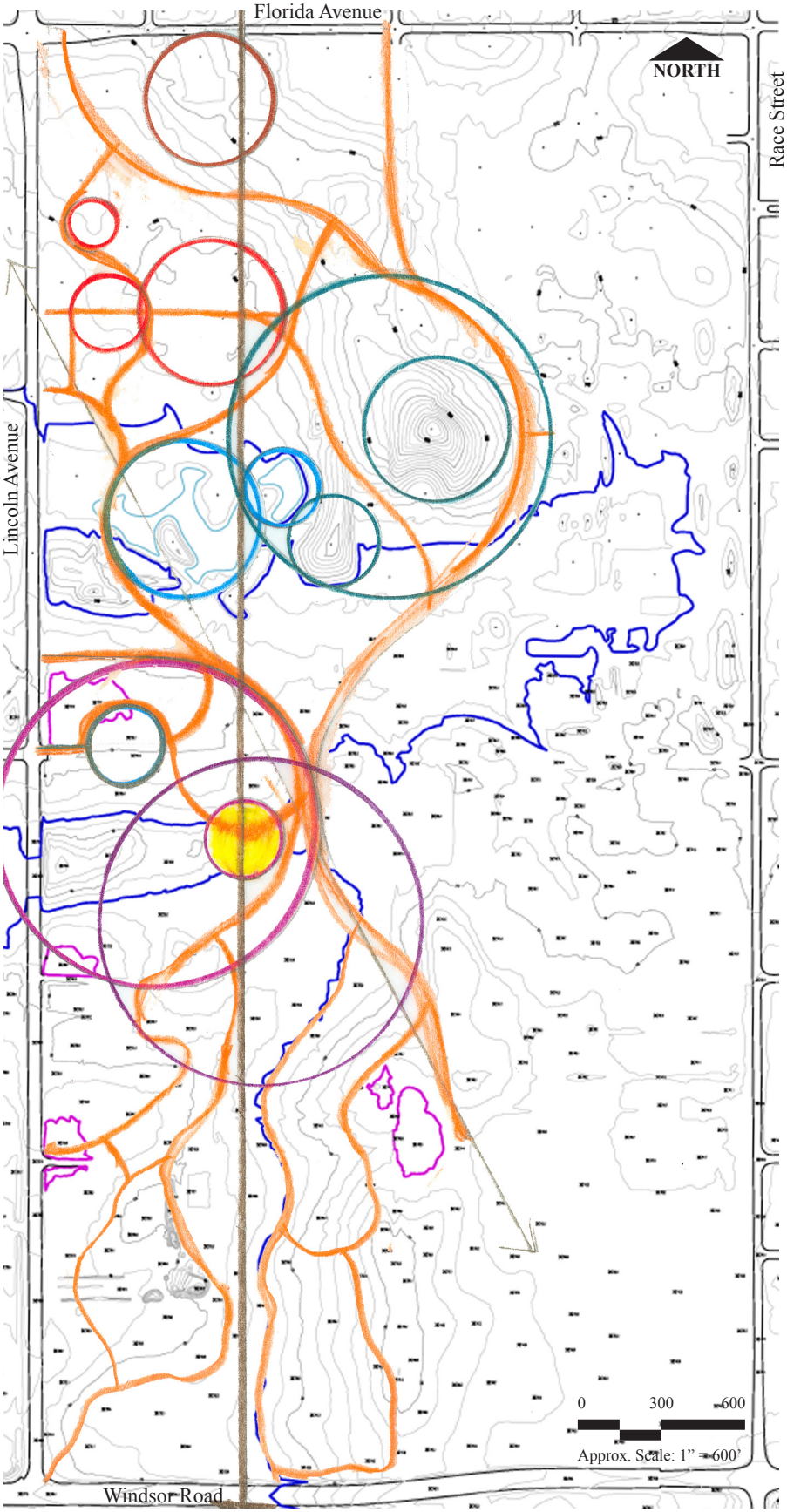

Figure 4.16 Relationship diagram highlighting proximity to existing arboretum elements.

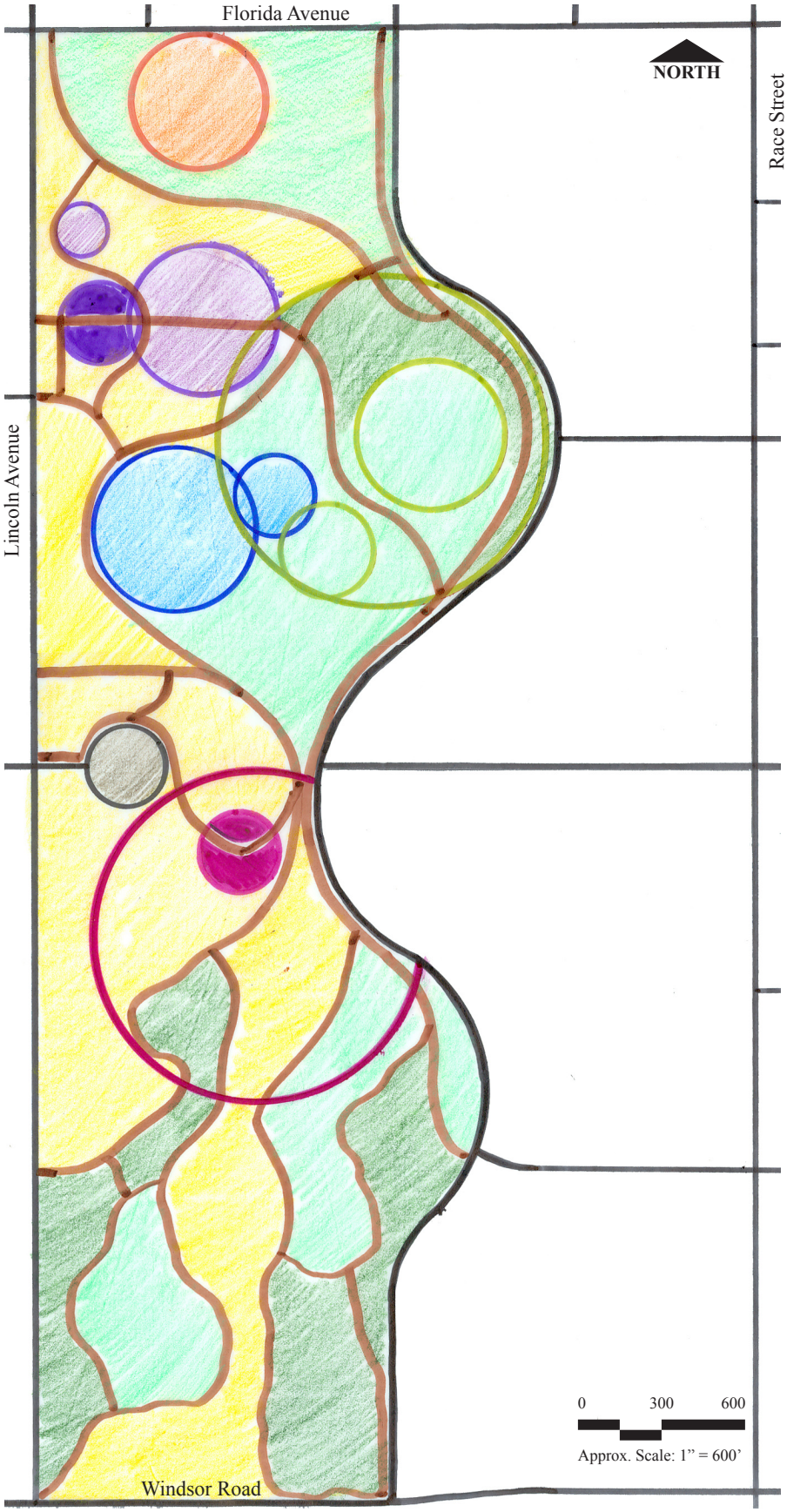

Figure 4.17
Framework diagram indicating preliminary garden and habitat spatial allocation.

Discovery Center would also be able to illustrate the relationship between the gardens and the habitats as landscapes that exemplify different types of plant communities and express different degrees of human influence and environmental influences (See Figure 4.16 and Figure 4.17).

4.4 Architectural Prototypes

The next stage in the design process was to determine the architectural language for the built elements in the Discovery Center area and to site the indoor educational facility. The Master Plan for the arboretum is very specific about the dimensions of each room to be contained within the Discovery Center building, and my goal was to fully satisfy these requirements.

At first I attempted to design a building from scratch, using local historic buildings in the Champaign-Urbana area as inspiration for the facility. I quickly realized that a more appropriate and useful building would be one designed by an architect specifically for educational purposes. I began researching building types for nature centers across the United States with the goal of experimenting with the relationship between interior and exterior spaces. I wanted the building to belong in its surroundings, using a palette of natural materials. I also wanted the arboretum to visually extend into the building and the building to physically extend outward into the landscape. I came across an architectural firm based in San Antonio, Texas, called Lake Flato Architects. The firm's philosophy is based on six principles: land, light, craft, community, spaces between, and sustainability. The principle of "spaces between" defines exactly the idea I had been seeking. In their words, "Our buildings blur the line between indoors and out through spaces that expand beyond their walls to form outdoor rooms" (Lake Flato Architects 2007). While Lake Flato's buildings are typically tailored to their specific site in order to best interact with their surroundings, unfortunately it was not feasible for me to commission their services to design a building tailored to the arboretum. Instead,

I browsed their portfolio and discovered a number of buildings that in my mind were suitable to function as an educational facility in central Illinois. The building I chose to implement currently exists as the Government Canyon Visitors Center in San Antonio Texas. In 2007 the project won the National AIA Committee on the Environment "Top Ten Green Award." For the arboretum, I modified the building to adapt to its new location but the basic structure and layout remain identical to the building at Government Canyon.

I chose this particular building for a number of reasons. First and foremost, the building allows for varying levels of indoor, outdoor, and intermediate experiences. The Visitors Center is comprised of three distinct buildings linked by overhead pavilions and boardwalks underfoot to create a series of interconnected spaces that satisfy the varied functions of any visitors center. Two of the buildings appear as triangular arms that reach horizontally out into the landscape. These low, one-story buildings contain classroom space, offices, rest room facilities, food service facilities, and storage space. Between them is a light, airy, and lofty exhibit hall that is appropriate for large group functions and temporary or seasonal displays. The three buildings are arranged in such a way as to create an interior, yet outdoor, space between them (See Figure 4.18).

The buildings themselves are made of four basic materials: wood, stone, steel, and glass. While the San Antonio building has large floor-to-ceiling screens in place of glass panels for some of the windows, it would be necessary for these to be altered to accommodate harsh Illinois winters. Also, the roof on the two horizontal buildings is raised above the top level of the walls to increase air circulation, allowing warm air to escape through the opening. In Illinois, at minimum one of the buildings would require a closed roof to allow for heating in the winter and cooling in the summer, while the other building could be constructed in the original manner for natural temperature control and experience of the elements (See Figure 4.19).

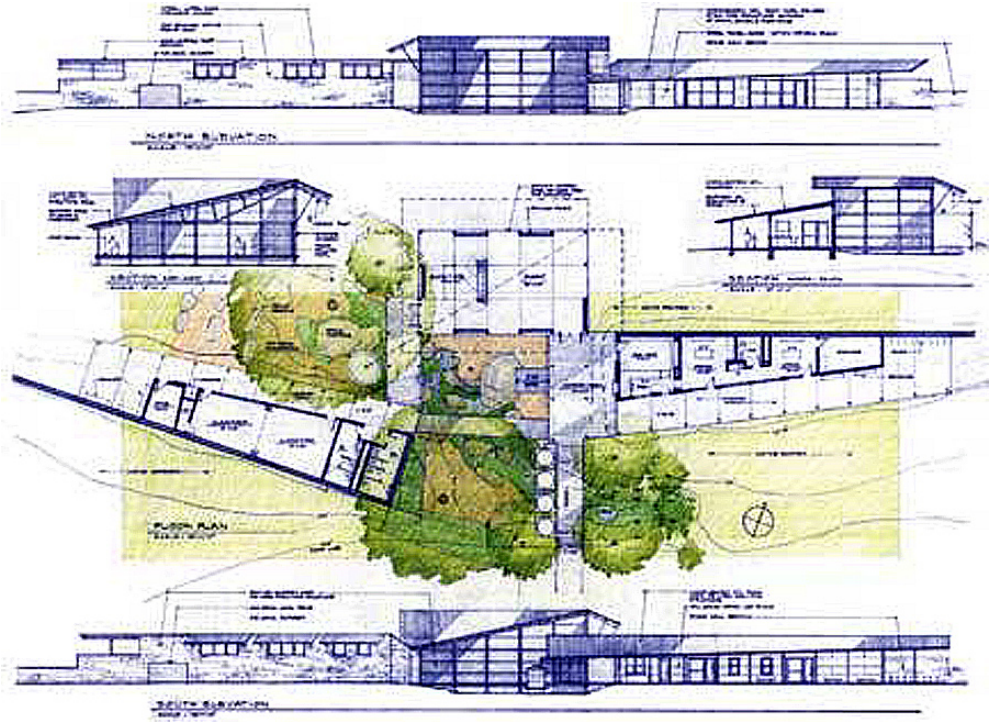

Figure 4.18
Government Canyon Architectural Plans
(Lake Flato Architects).

A.

B.

C.

D.

Figure 4.19 Government Canyon Images
A. North Building, south side; B. North Building, west side; C. North Building and West building; D. Building Interior (Lake Flato Architects).

4.5 Planting Design Theory

The planting plan for the arboretum is based on theories in planting practices that can be divided into three categories: cultural and environmental influences, plant community composition, and the question of natives, exotics, and invasives. The difficulty in designing for all of these objectives rather than just one is that contradiction between the theories leads to ambiguity of expression in the landscape. Because I have attempted to explore each theory in planting design within the arboretum, different theories and practices have been applied to different zones within the arboretum. The rationale for this method is that different theories are more appropriate for different visitor functions that take place in the arboretum and lead to different types of visitor-plant interactions.

4.5.1 Cultural and Environmental Influences

The planting design for the University of Illinois Arboretum is intended to demonstrate a progression from plant communities determined by environmental conditions and natural selection to plant communities determined by cultural conditions and human selection. These will be termed “environmentally determined plant communities” and “culturally determined plant communities.”

The intersection of environmental conditions and cultural conditions leads to the development of a third plant community type that has qualities of both types, which for the purpose of this project will be called “conditionally hybridized plant communities.” There are an enormous number of possibilities as to the characteristics of a conditionally hybridized plant community. These types of plant communities are the result of human interpretation of an ecological ideal. They are reminiscent of the naturally selected environment composition but are distinct from it based on the subjective aspect of human interpretation of the landscape.

Plant communities are further influenced by maintenance practices which affect the rate and manner in which transition takes place within the landscape. Additionally, variation in maintenance practices results in differences in aesthetic qualities of the plant material and the overall landscape, which relates back to both the cultural and environmental conditions of that particular landscape.

The planting design for this project is based on a matrix of environmental, cultural, and maintenance factors. I have attempted to demonstrate the range of plant community possibilities that result from the implementation of varied maintenance practices within each plant community type.

Table 4.1 Planting Design Matrix

Plant Community Type	Primary Influence	Maintenance Practice	Location Example
Woodland	Environmental	Invasives removal, natural weather processes	Habitats (south)
	Cultural	Pruning, mowing, irrigation, fertilization	Horticultural Collections (Center)
Savanna	Environmental	Prescribed Burns, natural weather processes	Habitats (south)
	Cultural	Mowing, selective pruning	Horticultural Collections (Edge)
Shrubland	Environmental	Invasives removal, natural weather processes	Habitats (south)
	Cultural	Pruning, irrigation, weeding, mulching	East Entry Garden, Grand Hill
Grassland	Environmental	Prescribed Burns, natural weather processes	Habitats (south)
	Cultural	Mowing, irrigation, fertilization	North of Discovery Center

4.5.2 Plant Community Composition

Four plant community types are expressed throughout the arboretum. These are woodland, savanna, shrubland, and grassland. These community types differ based on plant composition within the community and are defined by percentages of plant types that make up the community. A plant type is defined by the morphology of the plant, specifically its size, structural composition, and growth pattern.

The woodland habitat is defined by 80% or greater canopy cover of woody deciduous or evergreen trees (Illinois Natural Areas Inventory 2007). The woodland understory consists of shade tolerant trees, shrubs, herbaceous perennials, and ephemeral groundcovers (See Figures 4.20 and 4.21). The savanna habitat is characterized by 10% to 80% canopy cover of woody deciduous trees and an understory of herbaceous grasses and forbs (Illinois Natural Areas Inventory 2007). Savanna is frequently an intermediate habitat found between woodland and grassland areas both geographically and successionally (See Figure 4.22). The term "savanna" can also be used to describe parkland areas or open woods. A typical savanna habitat is found "on till plains and lowlands, as an ecotonal belt along stream forests, as 'islands' in prairie or forest, or on extensively hilly land" (Illinois Natural Areas Inventory 2007). Shrubland habitat is almost entirely deciduous shrubs or small trees in mass to form a dense thicket and is most commonly found as an edge habitat adjacent to woodland or grassland (See Figure 4.23). Shrubland can also be found as pockets within a woodland area, typically in an area where sudden access to sunlight permitted the proliferation of shrubby growth. Grassland habitat is composed of herbaceous grasses and forbs and has less than 10% canopy cover (See Figures 4.24 and 4.25). As the predominant plant community type in Illinois, there are many different types of grasslands that differ based on soil type and growth season. Grassland is typically adjacent to either savanna or other types of grassland. The arrangement of these habitats when determined by primarily ecological influences is based on succession over time and maintenance through natural events such as fire. In designing the arboretum I have attempted to emulate the arrangements found in nature in order to tell a story about ecological succession and expose visitors to each habitat within a relatively small amount of space and time. I have also attempted to express variations within each plant community type as an expression of ecotones, which will be discussed in more detail in Chapter 5.

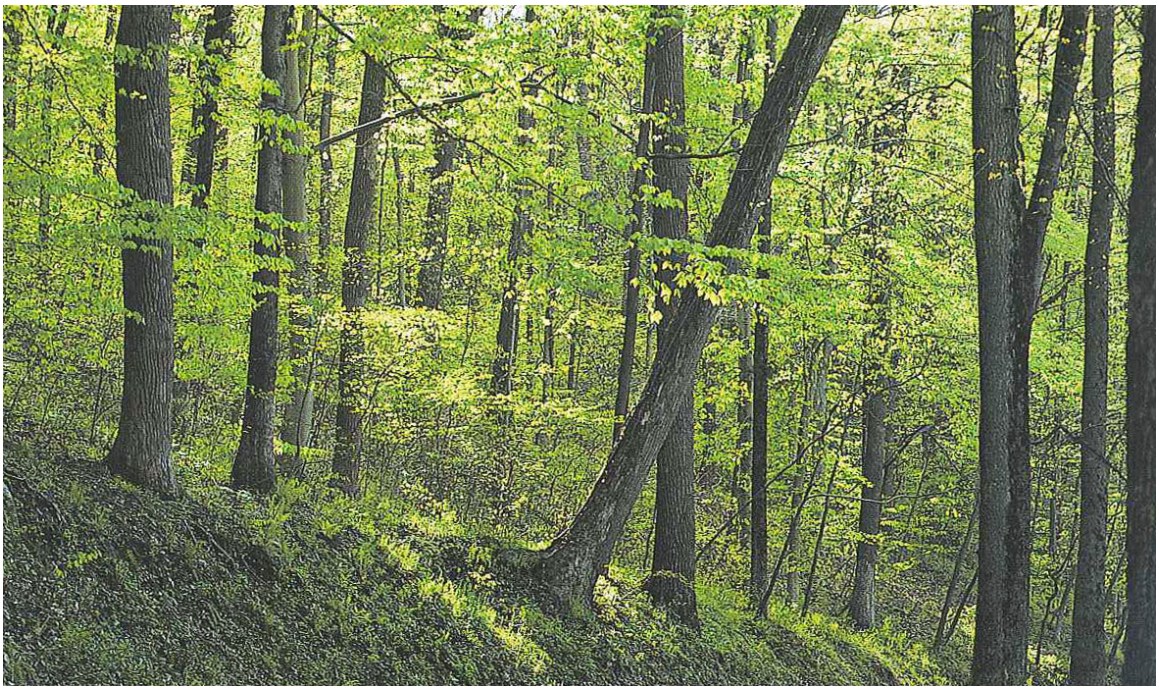

Figure 4.20
Woodland in Summer
(Darke 2002).

Figure 4.21
Woodland in Autumn
(Darke 2002).

Figure 4.22
Savanna
(Darke 2002).

Figure 4.23
Shrubland
(Darke 2002).

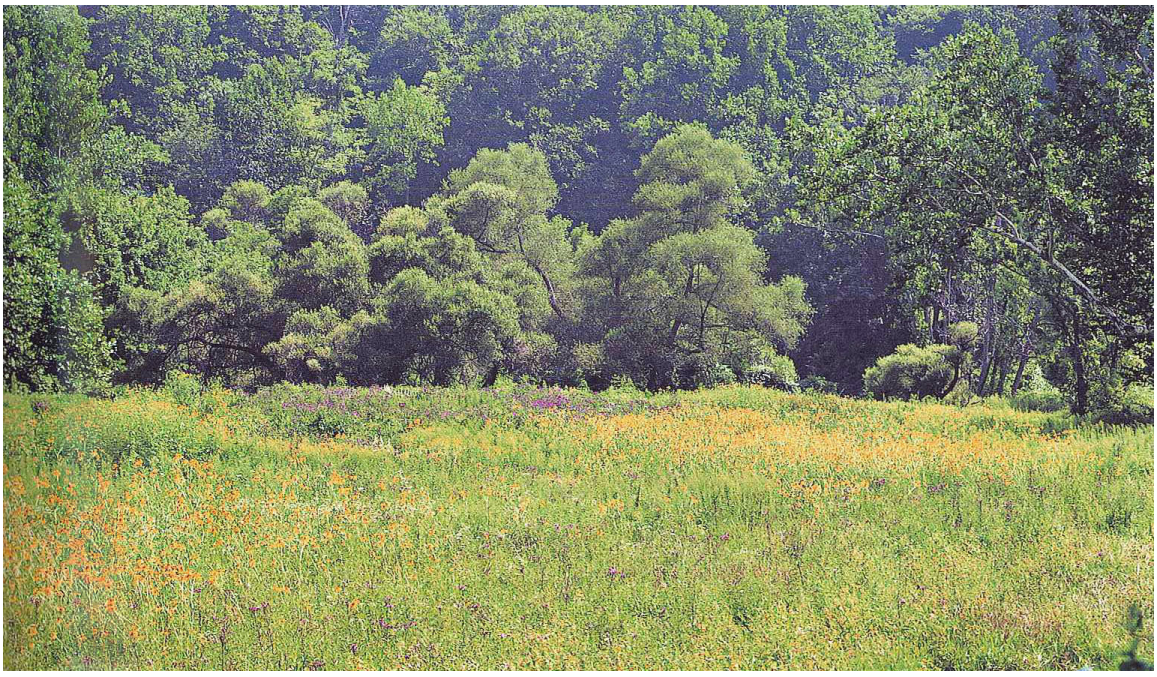

Figure 4.24
Grassland (adjacent to woodland)
(Darke 2002).

Figure 4.25
Grassland, unmown (adjacent to grassland, mown)
(Kanfer).

4.5.3 Natives, Exotics, and Invasives

There are many theories about how to make ecologically responsible decisions regarding plant composition in the design of so-called natural areas. It is important that I emphasize that the arboretum is not being treated as an opportunity exclusively for habitat restoration. The goal of the planting composition at the arboretum is to include both ecologically inspired landscapes as well as culturally inspired landscapes. Therefore, it is necessary first to define native plants, exotic plants, invasive plants, and non-invasive plants before making value judgements about appropriate usage of each type of plant.

Native plants are any plant species indigenous to a particular region, in this case central Illinois, or more specifically, Champaign County. Exotic plants are those that have been introduced to a region from elsewhere, typically via human intention or inadvertent transport. Invasive plants are those that have an aptitude for out-competing other plant species for resources such as nutrients, water, and sunlight, resulting in their rapid proliferation in a given area to the detriment of other plant species. Non-invasive plants are those that compete adequately for resources so that they are able to survive and reproduce, but do not have a tendency to spread rapidly throughout an area to the detriment of other plant species.

Based on these definitions, it is possible for a native plant to be either invasive or non-invasive, as well as for an exotic plant to be either invasive or non-invasive. Within the arboretum, natives, exotics, invasives, and non-invasives will be used. However, exotic invasives specifically will be avoided altogether. Exotic invasives are the most likely to disrupt established plant communities and lead to the necessity of intensive maintenance measures in order to re-establish the intended plant community composition. The design intent of the arboretum is to display a variety of distinct plant community types, and as such the presence of exotic invasives would be counterproductive to this goal. As for native invasives, in some areas of the arboretum it will actually be preferred that certain native plants take over an area quickly in order to establish the character of

the landscape. For example, in a grassland area intended to imitate native Illinois prairie the rapid establishment of a few native grasses makes it possible to keep undesirable plants from taking hold in the area, and creates conditions suitable for less prolific but equally desirable prairie plants to become established over time. As another example, in a woodland it is desirable for native plants to invade on a seasonal basis, in springtime in particular. The character of a mesic upland forest in spring is defined by a sequence of ephemerals that seem to carpet the woodland floor, with bluebells for instance, which then recede and make way for a mix of flowering plants to develop. Just as I have made the judgement that it is acceptable to use invasive plants as long as they are native, I am also making the judgement that it is acceptable to use exotics as long as they are non-invasive.

5.0 The Final Design

The final design for the arboretum at the University of Illinois serves three primary functions: to create an educational facility that serves the educational goals discussed in Chapter 3, to increase visitation and improve the visitor experience of the arboretum, and to demonstrate the theories of planting design explained in Chapter 4. The final design takes into consideration the existing Master Plan for the arboretum, the plans for future development of Orchard Downs and the South Campus of the University, and the arboretum's existing site conditions. The resulting design is a culmination of preliminary research, precedent studies, and design influences that occurred throughout the design process.

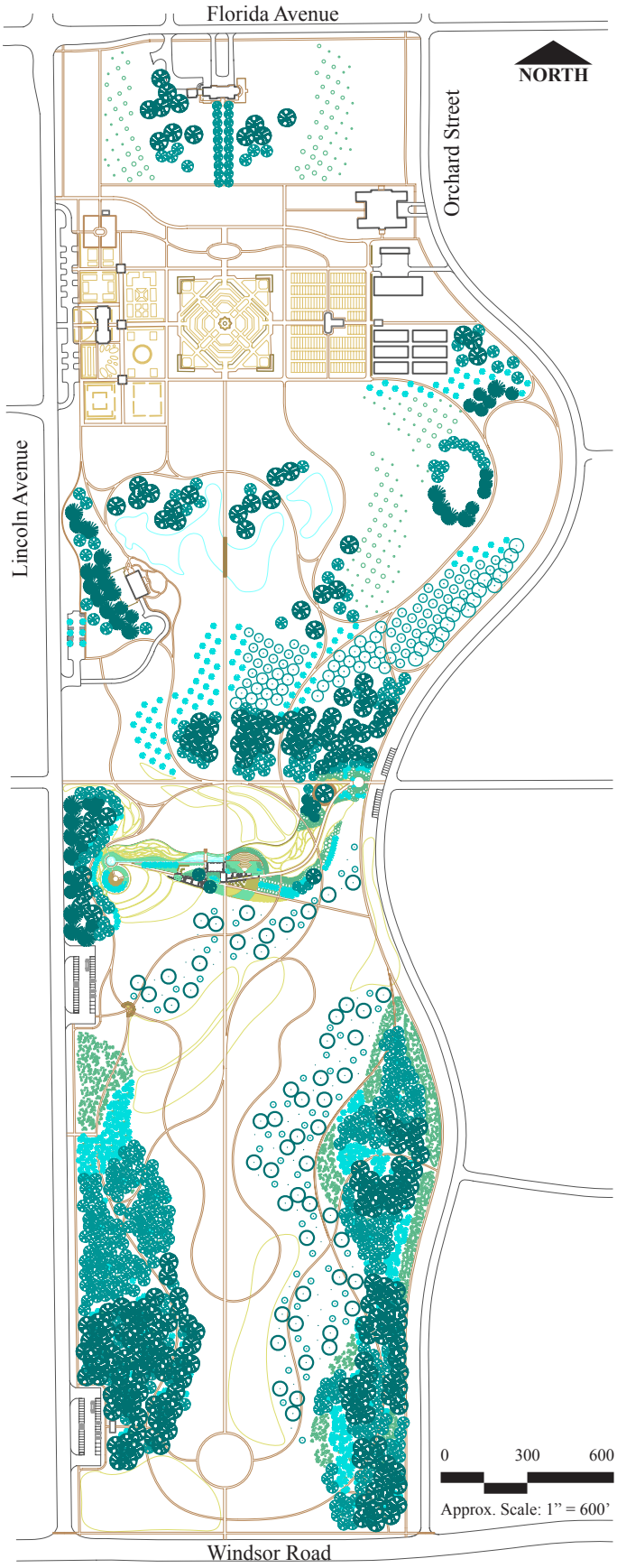

Figure 5.01
Final Arboretum Plan.

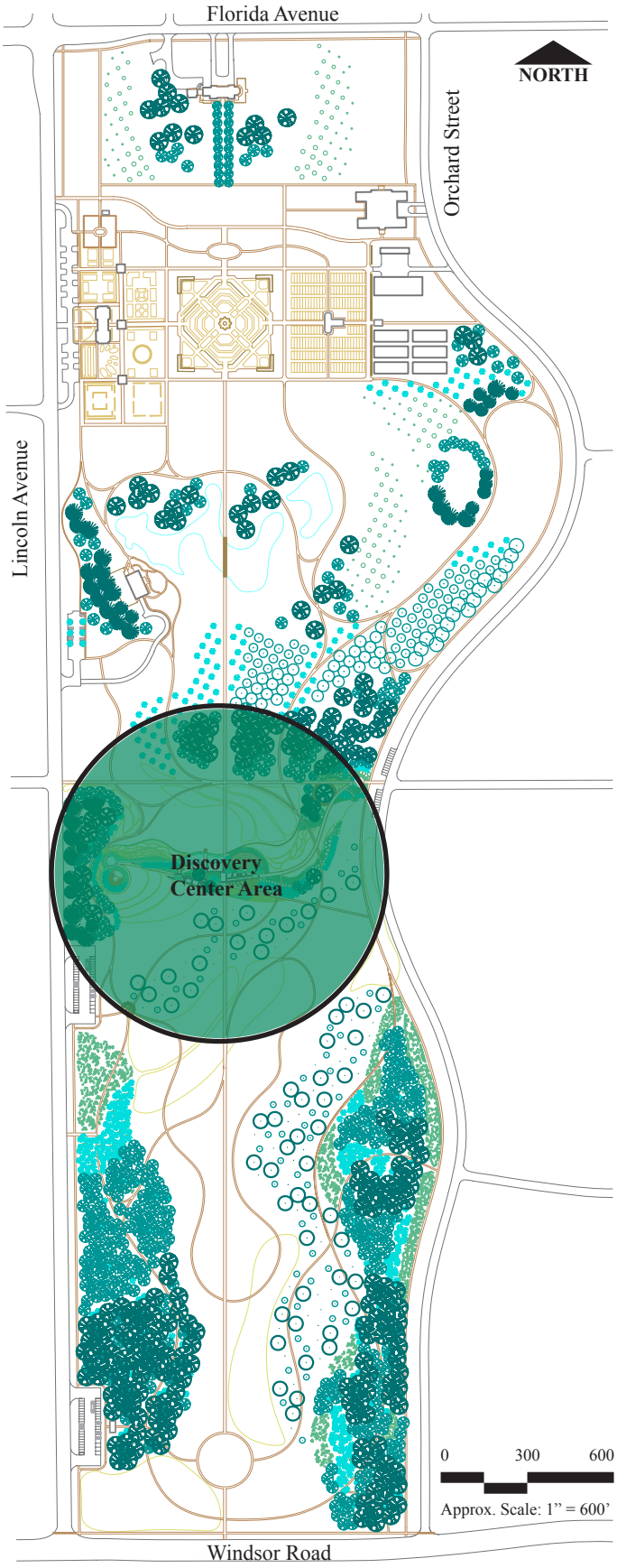

Figure 5.02
Discovery Center Location.

5.1 The Discovery Center

The design of the Discovery Center and the 10-acre site that it occupies is the primary focus of my design of the arboretum and has been considered in greater detail than the remainder of the arboretum. In this section I intend to "give a tour" so to speak of the facilities that have been incorporated to make up the educational center and potentially the primary visitation center for the arboretum.

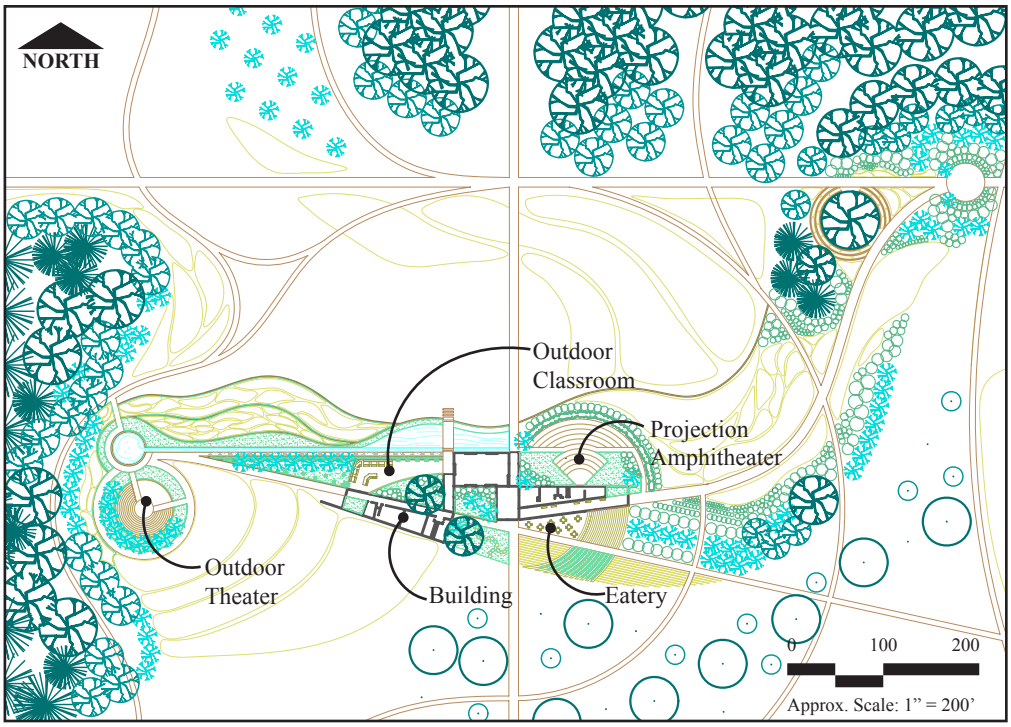

Figure 5.03
Final Discovery Center Plan.

5.1.1 The Building

As mentioned in Chapter 4, the architecture of the Discovery Center buildings has been borrowed from the visitor's center at Government Canyon in San Antonio, Texas, designed by Lake Flato Architects. The three buildings contain amenities intended to accommodate the needs of a variety of arboretum users, as outlined in the Master Plan. The east building contains many of the operational spaces required of an education center. Of primary importance are rest room facilities that can be accessed from both inside and outside the building, so that they can be used at times when the building is not open. The east building also contains kitchen facilities equipped with appliances necessary

for catered functions, which are adjacent to the outdoor eatery. It is anticipated that the arboretum would at some point require education staff, and therefore the east building has office space and storage space for educational program materials and supplies. The west building contains flexible classroom space that can be modified to accommodate different sized groups depending on the daily schedule. It also has storage space suitable for extra furniture and securing classroom electronics. Additionally, the west building has a small reception room that could be used as a visitor services station, an extra office, or a media room. The north building is a large open space that has the potential to serve a variety of functions ranging from large group lectures, to exhibitions, party rentals, corporate meetings, and retreats. Educational programs and north building rentals have the potential to generate revenue that may be reinvested in upkeep and improvements to the Discovery Center as a whole.

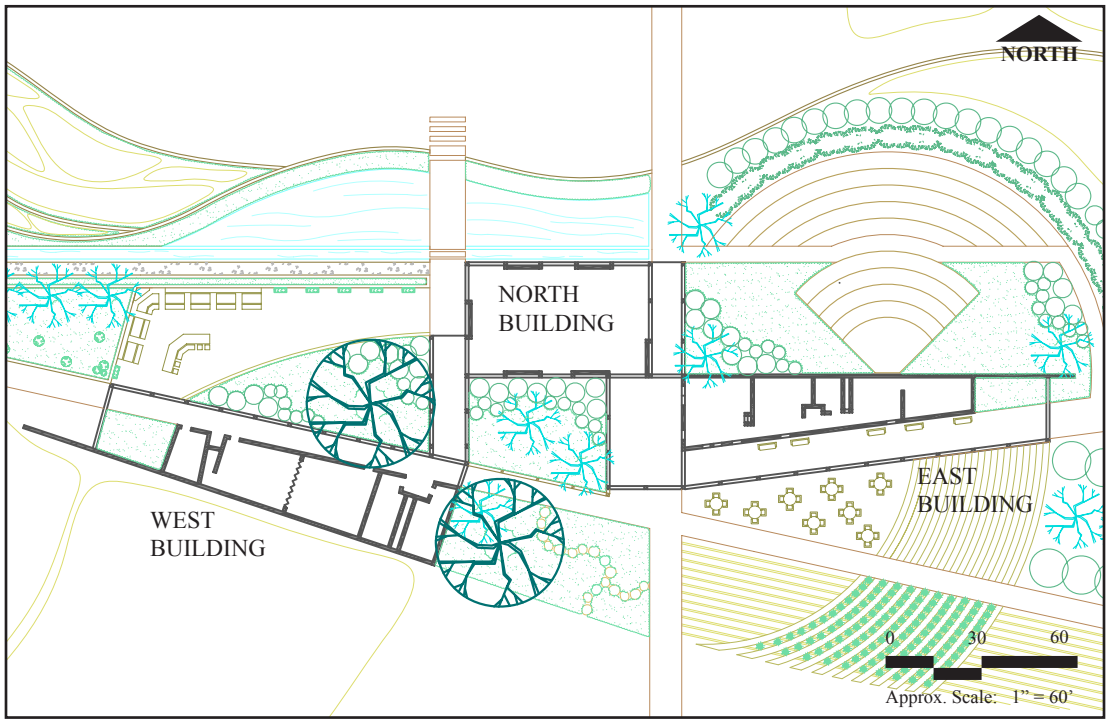

Figure 5.04
Building Configuration.

5.1.2 The Outdoor Classroom

I designed the outdoor classroom space to match the style and form of the buildings themselves and to provide an outdoor counterpart adjacent to the indoor classrooms. Located west of the north building and north of the west building, the outdoor classroom occupies a semi-private location, hidden from direct view from all directions except the north. It is also only physically accessed from two points, so that while a class is in session other visitors may pass by without walking directly through the classroom space. The outdoor classroom is a wooden deck structure raised eighteen inches above grade to tie into the level of the boardwalk that traverses east to west between the Discovery Center buildings. The deck has a four-foot tall solid wood railing on the west and north sides with built-in foot rests and bench seating. Seven wooden picnic-style tables are anchored to the deck floor with a surface height of four feet. Moveable wooden bar stools can be arranged on the interior side of the tables. A teaching table, also four feet high, is anchored to the deck and situated to have an ideal vantage point for demonstrations so that the instructor has a clear view of all the students and each student has a clear view of the instructor. The curved south edge of the outdoor classroom has a twelve inch toe-kick to prevent visitors from accidentally stepping into the pocket garden at ground level between the outdoor classroom and the boardwalk. This pocket garden has been created to mimic the adjacent garden that is part of the original Lake Flato design, as well as to soften the classroom's edge that is adjacent to the buildings. The intended character of the space is to create a feeling of being out in the garden while still being only steps away from indoor facilities.

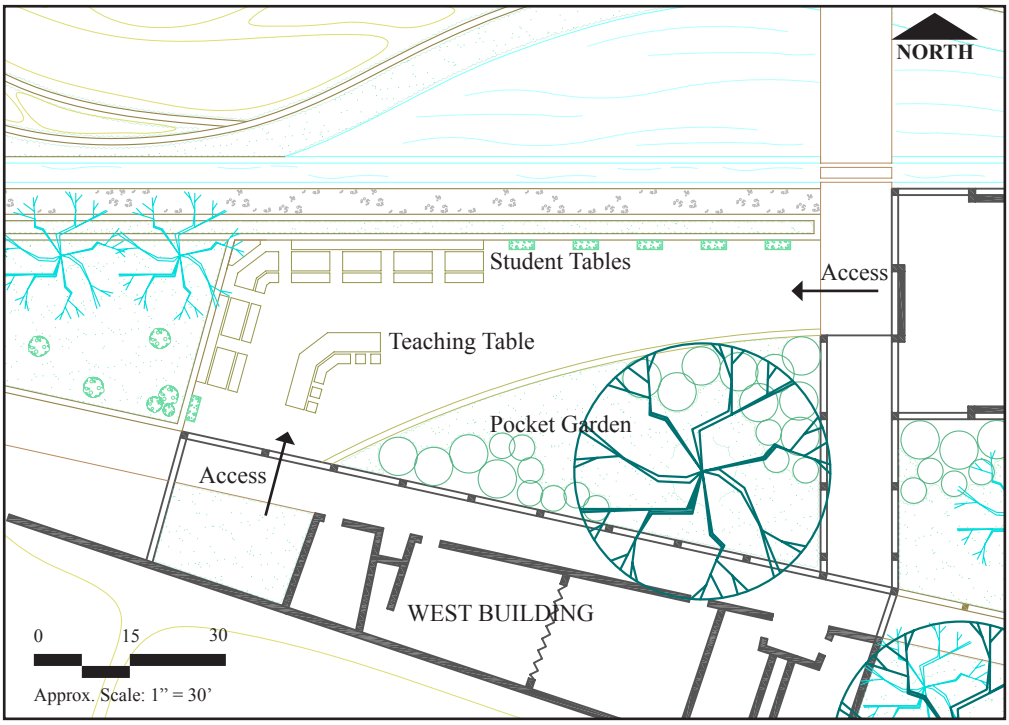

Figure 5.05
The Outdoor Classroom.

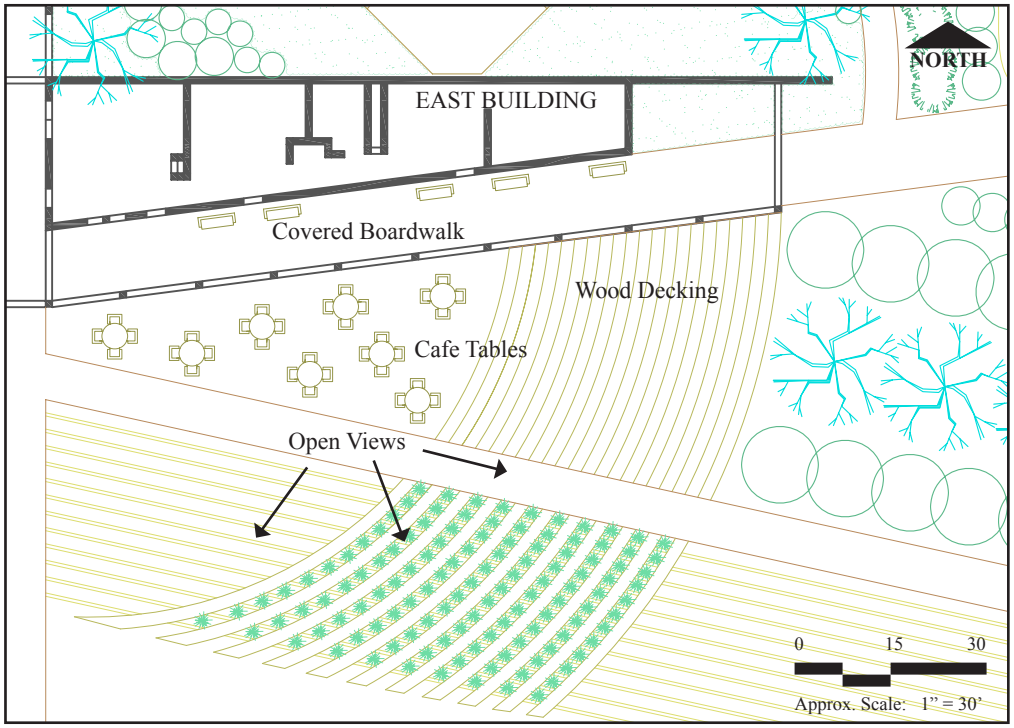

Figure 5.06
The Eatery

5.1.3 The Eatery

The outdoor eating area is similar in character to the outdoor classroom, but with a sunnier exposure and expansive views to the southern half of the arboretum. It is made of identical wood decking and is furnished with wooden cafe tables and chairs to seat 30 people. The eating area is intended to act as a casual resting spot centrally located within the arboretum and to provide a comfortable eating area for school groups to have lunch. The eatery is intended for use by groups that are providing their own refreshments or for catered events, and as such the Discovery Center does not include a cafe where food and beverages may be purchased.

5.1.4 The Projection Amphitheater

While the master plan does not call for a projection amphitheater, my goal in designing the Discovery Center was to incorporate all appropriate educational facilities into an outdoor setting. I envision the projection amphitheater being used for movies, lectures, and presentations of all kinds. It is a rare occasion in today's university setting that a presentation is given without the use of digital media of some kind, and therefore it is not only desirable but necessary to include media opportunities in the design of the Discovery Center.

The projection amphitheater has been designed to accommodate small groups of 30 people or fewer and large groups of up to 100 people. For small groups, the projector is placed 15 feet from the viewing screen to produce and image of 4 feet-6 inches by six feet. For large groups, the projector is placed 20 feet from the viewing screen to produce an image of 6 feet by 8 feet. The image is projected toward the north wall of the east building where a wire mesh screen is permanently mounted to the side of the building's stone wall. The amphitheater is made of 6 feet deep by 18 inch high tiers with dry-laid stone risers and lawn treads. A walkway passes through at the mid-level of the amphitheater for ease of access to the lower media box, which is built into one of the tiers

for small group viewing sessions. Another media box is built into a low pedestal on the top tier for large group sessions. The electrical input would be wired underground to the east building.

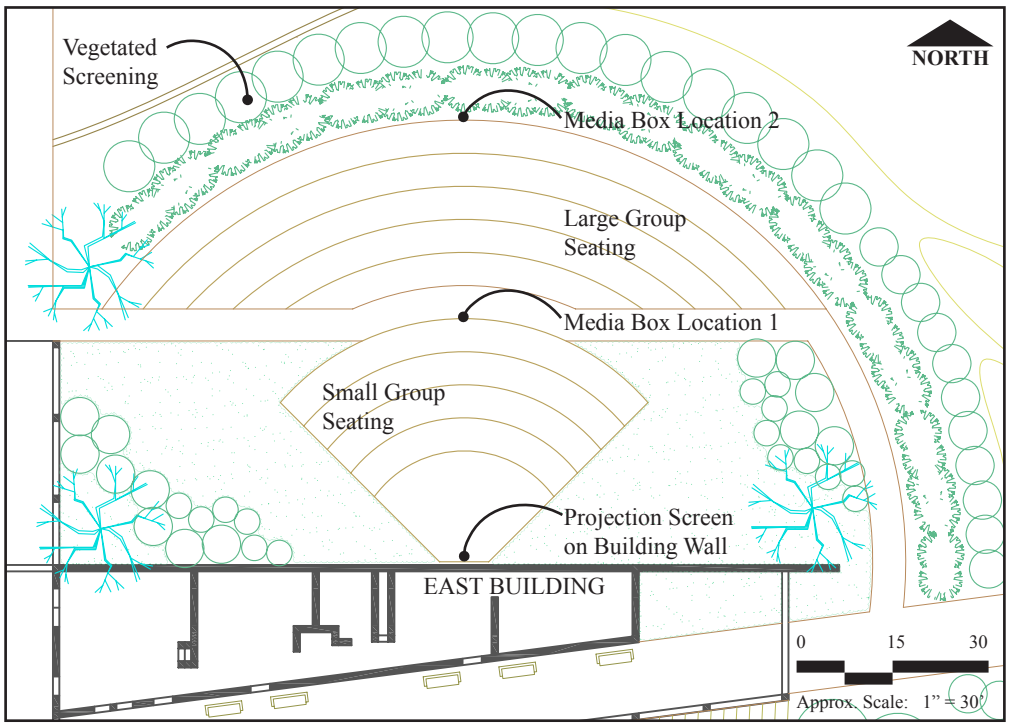

Figure 5.07
The Projection Amphitheater.

5.1.5 The Outdoor Theater

The outdoor theater differs from the projection amphitheater in two ways. First, it does not have media capabilities, and second, it accommodates a vastly greater number of spectators, up to 250 people. The outdoor theater is intended for very large group lectures and outdoor performances. The theater is designed with the stage facing southwest toward an evergreen woodland backdrop and the audience oriented northeast with a panoramic view of grassland bordered by the woodland horticultural collections. This arrangement has two purposes: to block the sights and sounds of Lincoln Avenue and to prevent obstructed views due to sun angle and orientation. Since the sun is angled south to varying degrees at different seasons, it is necessary to prevent both performers and spectators from having the sun in their eyes. The spectators face northeast, so the only time of day that sun would be a problem would be in the morning. For performers,

the sun would be an issue from mid-afternoon until the sun drops below the tree line of the wooded area that envelops the theater on its east side. For this reason, the ideal time of day for performances would be midday and at any point in the evening. The woodland to the east of the theater is layered with evergreen trees to block sound and deciduous canopies providing the height necessary to block the sun. The woodland curves around the spectator seating area to block northbound and southbound traffic noise as well as to block any view of Lincoln Avenue to the north.

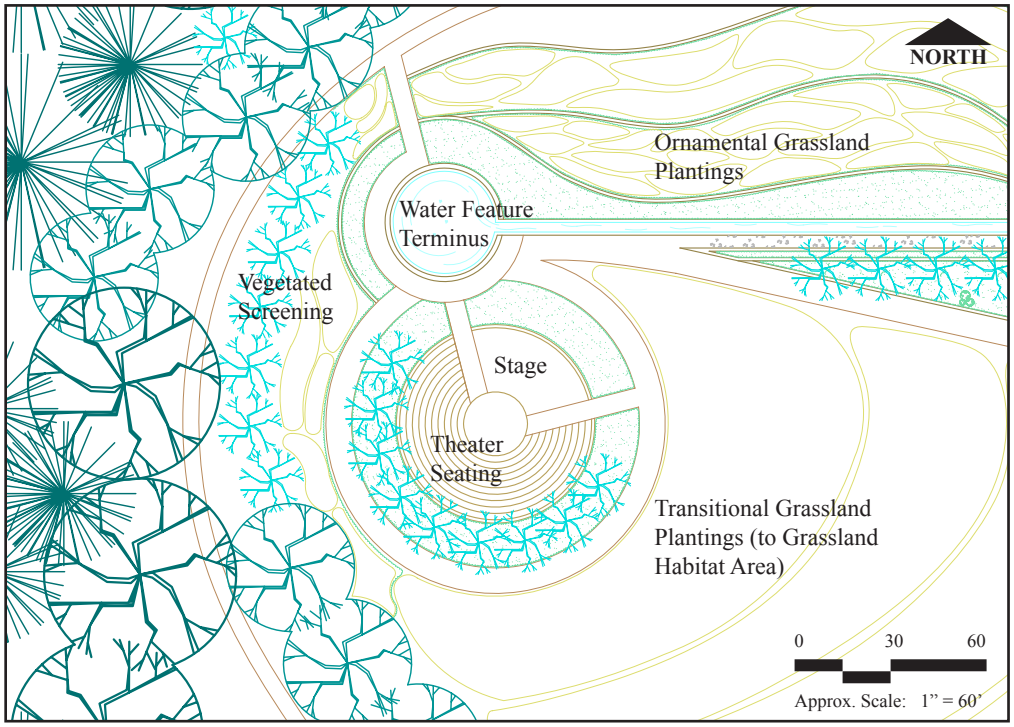

Figure 5.08
The Outdoor Theater.

5.1.6 Pedestrian Extensions

The architecture and arrangement of the buildings lend toward extensions out into the landscape, successfully integrating the experiences of interior rooms and exterior spaces. Two primary walkways bisect the three buildings north to south and east to west. The east-west walkway links the east building and west building with the dining area, outdoor classroom, and outdoor theater, while the north-south walkway links the north building and east building to the projection amphitheater. The east-west walkway, beginning at the east end of the east building, is at first a covered walkway that traverses

the length of the south side of the east building. The path then crosses at the south end of an open-air pavilion and continues westward past a semi-enclosed garden. The walkway progresses underneath the covered walkway along the north side of the west building, passing the outdoor classroom before progressing at a slightly elevated vantage point with views toward the habitat areas to the south and onward to the outdoor theater. The west end of the walkway wraps around the outdoor theater at its terminus. The east end of the walkway winds its way through garden areas to the Discovery Center's main pedestrian entrance on the arboretum's east side. The north-south walkway is the central pedestrian avenue through the entire arboretum, extending visually from the President's allee and physically from the Hartley Gardens on the north end all the way to the Circle Garden at the arboretum's southern edge. The buildings have been situated such that this walkway passes between the north building's east wall and the east building's west wall. The advantage of this situation is that it brings visitors directly through the Discovery Center as they travel throughout the arboretum.

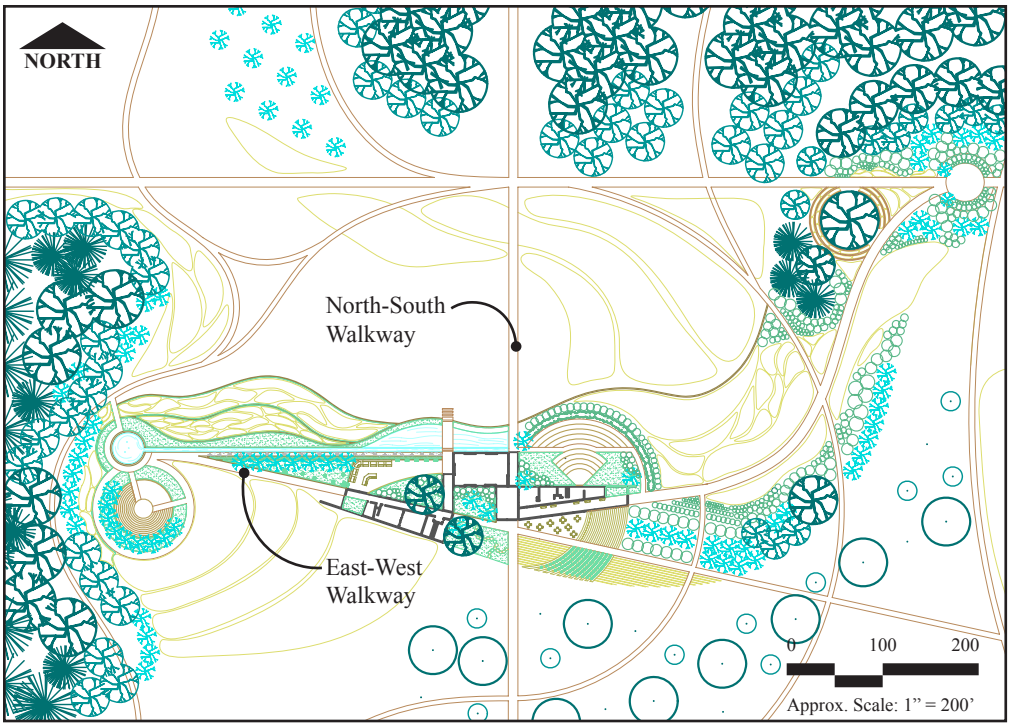

Figure 5.09
Pedestrian Extensions.

5.2 Visitor Experience

In order for the educational mission of the arboretum to be achieved, it is necessary to increase visitation and improve the visitor experience of the arboretum. These things can be accomplished through the implementation of three elements: a well-planned system of pedestrian circulation, the incorporation of visitor wayfinding devices, and the development of a visitor interpretation plan.

5.2.1 Circulation

The circulation system for the arboretum has been designed to accommodate users arriving by bus, car, bicycle, and on foot. Within the arboretum itself, only pedestrian traffic is permitted, with the exception of arboretum utility and maintenance vehicles. Bicycles will be restricted to paved pathways, which are located around the perimeter of the arboretum, as well as on main pathways through the arboretum. The remaining pathways will be for visitors on foot only.

The circulation plan begins with an analysis of the points where visitors are most likely to arrive at the arboretum depending on their type of travel. Visitors arriving by vehicle (bus or car) will primarily enter from Lincoln Avenue and to a lesser degree the newly revised Orchard street. Two new parking areas have been developed along Lincoln Avenue, each able to accommodate city and school buses entering, exiting, and parking in these lots. I chose to create these smaller parking areas rather than a large parking area so that visitors might park near their desired destination within the arboretum, as well as to reduce the visual impact of a large paved area in an otherwise park-like setting. These parking areas would have metered parking that would ideally contribute financially to the arboretum itself. On Orchard Street, the parking areas would accommodate a smaller number of cars, most likely occupied by local visitors choosing to avoid the main roads in order to access the arboretum.

In order to determine where pedestrian and cyclist visitors might enter the arboretum I consulted the City of Urbana Greenways Plan (See Figure 2.05). Currently, the city has implemented a bicycle route along Windsor Road which is the southern boundary of the arboretum. In my proposal, a bicycle route through the arboretum would begin at Windsor Road and continue north along the east edge of the arboretum. Bicycle parking is located at the east entrance, the Discovery Center, and at each vehicular parking lot. The Urbana Greenways Plan also intends to create a link between a variety of public greenspaces in the vicinity of the arboretum, namely Meadowbrook Park and Carle Park. This connection would lead to pedestrian visitors arriving at both the southeast and northeast corners of the arboretum. These locations would have amenities to introduce visitors to the arboretum. These nodes would have small shelter areas, bench seating, large poster-size maps of the arboretum with "you are here" indications, drinking fountains for people and pets, pet waste baggies and receptacles, and seasonal arboretum brochures.

Once inside the arboretum, the visitor has a number of choices that ultimately dictate their experience of the arboretum. A visitor who has consulted a map could choose their direction accordingly in order to get to the sites they find most interesting. A mapless visitor would choose a direction randomly and encounter arboretum elements along a more whimsical journey. With the exception of the major north-south pathway through the center of the arboretum, all pathways have been designed as a loop so that it would be very difficult for a visitor to get lost in the arboretum. While there are many nodes equipped with varying visitor amenities throughout the arboretum, I chose to limit those with maps to only a few key locations. I made this design decision in order to encourage unguided exploration and to investigate the possibilities of other types of visitor wayfinding devices.

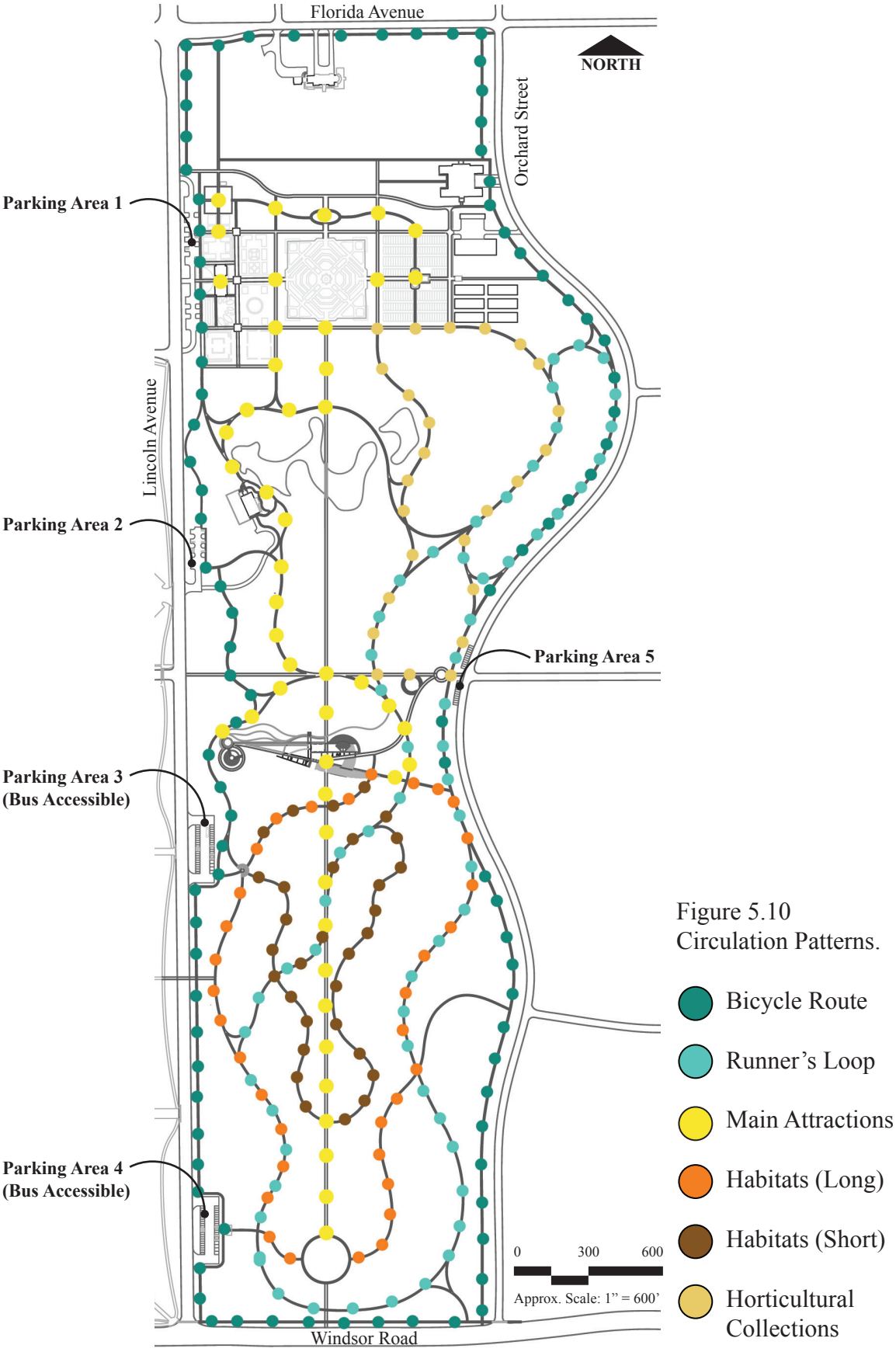

Figure 5.10
Circulation Patterns.

5.2.2 Wayfinding

Four types of wayfinding devices have been employed in the arboretum. These are signage, maps, views, and paving surfaces. Each wayfinding device is intended to assist the visitor in his or her experience of the arboretum either directly or indirectly. Signage and maps are a direct form of wayfinding in that they provide the visitor with specific graphic and textual information regarding a particular topic. Views and paving surfaces are indirect wayfinding devices in that they indicate transitions and location within the arboretum using only sensory perception.

Signage is used primarily to increase the visibility and relevance of the arboretum. Large signs of similar style and material will be located at each of the four corners of the arboretum as an announcement to passers-by that they are approaching the arboretum. The font size for large signs will be based on what can be easily read at 35 mph. These signs will be accompanied by highly maintained plantings to entice people to stop and take a walk through the arboretum. Less prominent signs will be located at each major attraction within the arboretum, for example, “The Discovery Center” and “The Visitors Center” and “Japan House” etc. A third type of signage will be used to convey a particular interpretive message, such as a sign explaining succession in a woodland or the chemical process of leaf color change in autumn. A fourth type of sign will serve as botanical labels to identify species and varieties of plants within the arboretum.

Table 5.1 Types of Signage

Sign Type	Size	Purpose	Locations
Arboretum Entry Signs	Large: 35 mph visibility	To announce arboretum presence and location.	Four corners and five parking area entries.
Arboretum Attraction Signs	Medium: 2’ tall by 4’ wide Height varies	To identify core elements within the arboretum.	At entries to each core element (Ex: Discovery Center, Display Gardens).
Interpretive Signs	Small: 2’ tall by 2’ wide 32” height above grade (top of sign)	To explain educational concepts and provide wayfinding information.	Throughout the arboretum, with emphasis at arboretum nodes.
Botanical Signs	Extra Small: 2” tall by 5” wide	To convey taxonomic botanical information.	Throughout the arboretum with an emphasis in the Horticultural Collections and Display Gardens areas.

Maps serve two purposes: to orient visitors to their surroundings in the arboretum and to provide direction as to where they should go next. The general brochure for the arboretum will contain a map of the entire property that graphically depicts the five major areas of the arboretum: The Display Gardens, the Horticultural Collections, Japan House and Gardens, the Discovery Center, and the four basic habitats. Additional maps will be developed on a case-by-case basis for specific programs at the arboretum. The Washington Park Arboretum in Seattle uses this method to supplement visitor exploration by developing monthly "tree walk" maps that guide the visitor to the most interesting or attractive plants during that month. This same concept could be applied to the University of Illinois arboretum. In addition to tree walk maps, educational program maps would enable visitors to take a tour of distinctive elements at the arboretum in a similar fashion to what is employed at the Champaign County Forest Preserve District (CCFPD) in Homer, IL. The environmental educators at the CCFPD have developed programs on specific topics geared toward particular trails within the preserve. On an ornithology walk, for example, the naturalist points out a dead tree where yellow-bellied sapsuckers have repeatedly pecked holes to find tasty insects inside; they also locate the barred owl's favorite tree and look for owl pellets underneath. On an insect walk, the naturalist looks for hornets' nests and milkweed galls at their most likely locations. At the arboretum, once these types of educational elements have been identified and linked to a particular program, a map would be developed so that visitors could essentially be their own naturalist and discover these treasures on their own.

The sequencing of open views and enclosure are of primary importance within the arboretum in order to create a varied and interesting visitor experience. Enclosure enables the visitor to take a journey through different areas of the arboretum in relatively close proximity that, through lack of visual connection, are experienced as distinct spaces. Open views, conversely, provide a comprehensive view of the arboretum as a whole and orient the visitor to his or her surroundings. Site lines are also employed to

develop a sense of attraction to the arboretum from outside its boundaries. The Discovery Center has been situated such that people traveling by car on Lincoln Avenue have a clear view of the Center as they approach from the north or from the south, but the view is blocked directly west of the Discovery Center so as to provide a visual and sound barrier to visitors within this area of the arboretum. On the east side of the arboretum a reverse effect has been applied; as one approaches from the south the Center is hidden from site by woodland until just before reaching the arboretum, and as one approaches from the north view of the Discovery Center is blocked by the hill until one rounds the bend in the road at its base. This tactic is intended to create a sense of revelation and increase the perceived relevance of the Discovery Center within the arboretum. While walking through the arboretum, there are certain locations with long, open views that orient visitors to their surroundings. For example, a person walking along the north-south central axis would be able to see the Center at all times, as well as Windsor Road if they are south of the Discovery Center and the President's house if they are north of the Discovery Center. This has been done intentionally so that as one traverses the different path loops they eventually come to a place where they can visually orient to a place in the distance where they had been previously. The pathway loops are different from the north-south axis in that they seek to bring the visitor along a sequential journey that passes from one enclosed space to another, creating a sense of visual compression and release.

While paving surfaces may not at first be thought of as a wayfinding device, different materials underfoot give visitors clues as to the proximity or distance from major nodes within the arboretum. There are five different paving types in the arboretum that serve different purposes; these are asphalt, concrete, stone, crushed granite, and mulch. Asphalt is used only around the perimeter of the arboretum and will have a yellow center line for bicycle use. Concrete is used for the north-south path, the east-west path (except where it is a wooden boardwalk), and through most of the display gardens. Stone is used in parts of the Discovery Center and at secondary nodes throughout the

horticultural collections and the habitat areas. Crushed granite is used for the running circuit, excluding where it crosses paths paved with asphalt or concrete, as well as a transition material between solid paving and mulch paths. Mulch is used in the most remote areas of the arboretum, the woodland areas in particular. The general concept is that more solid paving indicates you are close to central facilities such as shelter and parking, whereas softer paving indicates a more remote location. Interestingly, it is not necessary to indicate this method on any maps or interpretive elements within the arboretum because people are naturally able to perceive this hierarchy of pathways. Thus, paving surfaces are a subtle yet effective wayfinding device.

5.2.3 Interpretation

Interpretation at the arboretum is directly related to wayfinding devices because interpretive elements are integrated with the wayfinding plan specifically related to signage and mapping. Interpretation is another layer contributing to visitor experience that seeks to introduce visitors to educational concepts expressed within the arboretum. Maps identifying site-specific ecological artifacts are an example of an interpretive element. Botanical identification signs are also intended for visitor interpretation of the arboretum. Something as simple as a bench oriented to face a particularly nice view is also an interpretive element, but with a more subtle approach perceived differently by each individual visitor.

Interpretation is implemented through the creation of nodes and internodes, the incorporation of symbols and labels, and the development of prescribed routes through the arboretum. There are two types of nodes at the arboretum which will be called primary nodes and secondary nodes. Primary nodes are those equipped with visitor amenities such as shelter, seating, water fountains, waste receptacles, and signage. Secondary nodes are essentially rest points along pathways, distinguished by a change in paving material and typically equipped with seating. In Figure 5.11, the large green

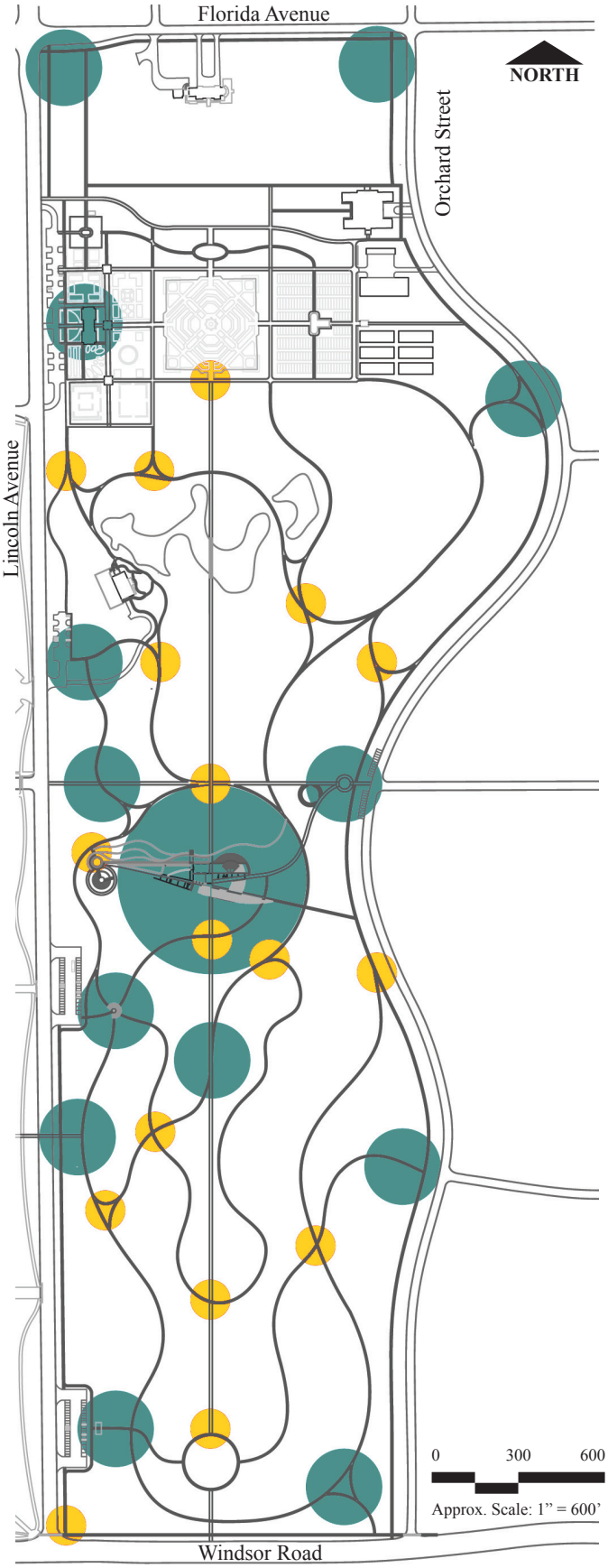

Figure 5.11
Interpretive Nodes

Primary Nodes

Secondary Nodes

circles are primary nodes and the small yellow circles are secondary nodes. Labels will be applied to identify plant species with a system of symbols indicating the plant community that the species belongs to. As one travels through the arboretum, transitions between plant community types can be interpreted through symbols located on botanical signs indicating which plants are most prevalent in a particular community as well as which plants overlap between different communities. Prescribed routes through the arboretum are identified by a separate set of symbols, so that visitors may choose to follow a particular path of a particular distance and experiential focus.

5.3 Planting Design Applications

Figure 5.12 depicts the four plant community types that make up the planting plan for the arboretum. What is most evident in this plan is the proportionally large amount of grassland compared to other plant community types. This distribution is intentional; grassland communities are below the human line of vision, which enables a clear sight line from north to south across the length of the entire arboretum. Additionally, grassland historically occupied a greater proportion of land both locally and regionally and therefore a greater percentage of this plant community type is appropriate from a historical and educational standpoint.

The planting schematic in Figure 5.12 also illustrates the spatial relationships between the different plant communities. On this map all shades of yellow are grassland, shades of orange are shrubland, greens are savanna, and browns are woodland. As defined earlier, this terminology refers to the percentages of vegetative cover in an area and does not correlate to habitat or ecologically inspired landscapes versus designed or culturally inspired landscapes. As such, each type of plant community is present in various areas throughout the arboretum.

Figure 5.13 illustrates the distribution of different ecotones within the grassland areas. These ecotones are defined in part by species composition and in part by

maintenance practices. The large expanse north of the Discovery Center differs from the large expanse south of the Discovery Center in two ways: the area to the north is a monoculture of Kentucky Bluegrass that undergoes a regular maintenance schedule of mowing and fertilization whereas the expanse to the south is a central Illinois prairie seed mix that is maintained through controlled burns on a three-year rotational cycle. This means that 1/3 would be burned this year, another 1/3 next year, the remaining 1/3 in the third year, and so on. The brighter yellow grassland areas in the Discovery Center area are three different grass and forb mixes that vary according to percentage of natives and exotics as well as color palette for the overall mix.

The woodland areas are shown in Figure 5.14. The woodland areas south of the Discovery Center are intended to be developed as different successional phases within the woodland. The light brown represents a young woodland where numerous saplings and smaller trees dominate the landscape and are able to successfully compete for light and other resources. The darkest brown represents and old growth forest characterized by relatively few large, established oaks and hickories and with a fully developed and diverse shady understory. Medium brown areas are the intermediate stage, where some saplings have persisted and become larger trees but enough sunlight remains for new saplings to sprout in the understory along with herbaceous ephemerals. Note that the woodland along the west side of the arboretum attempts to separate these woodland types so that as a visitor walks along it is as though they are walking through time to the different successional stages. The woodland along the east side of the arboretum is a more realistic woodland interpretation, where the ecotones weave together to create a mosaic. This occurs as a result of natural processes whereby, as older growth dies and begins to decay, seeds that have been lying dormant sprout up due to sudden access to sunlight.

Evergreen woodland areas are found in two locations: west of the Discovery Center and west of the Japan house, both for the purpose of screening the noise and views

of Lincoln Avenue. The horticultural collections area is also considered to be woodland where the ecotones are actually distinguished by isolated family groupings. These collections are bordered to the south by the nut grove, an established woodland area that exists in the current arboretum setting.

The savanna areas shown in Figure 5.15 are differentiated in ways similar to those of both the grassland and the woodland area. The north half and south half of the arboretum in regards to savanna plant communities are distinguished by a mow (north) or no-mow (south) maintenance method. The north savannas are essentially typical parkland in that they are characterized by groves of widely spaced shade trees underplanted with turfgrass. The south savannas are traditional savanna habitats that are characterized by widely spaced shade trees with an understory of prairie grasses. The three savanna types to the south differ in their degree of successional development. The lighter greens adjacent to the prairie are early-stage savanna with a greater number of young shade trees. The medium green has only a few large established shade trees (such as Burr Oak) mixed with young trees and is a more mature savanna. The darkest green, adjacent to woodland areas, is starting to transition toward woodland and has both old established shade trees mixed with a few shade tolerant understory trees.

The shrubland areas make up the smallest plant community within the arboretum, shown in Figure 5.16. Shrubland in each location is essentially a mass or dense thicket of shrubs closely spaced together. Shrubland differs according to species composition and spatial relation to other plant communities. Shrubland is located either as an edge or corridor along woodland or grassland, or as a pocket within a woodland area. On the south half of the arboretum, shrubland is made up of one or a few species in a thicket. On the north side of the arboretum shrubland is a diverse mix of ornamental masses arranged according to size, texture, and color to create a soft visual mosaic in the middle tier of the landscape.

Overall, the planting design for the arboretum is comprised of four plant community types: grassland, woodland, savanna, and shrubland. Each is distributed in varying amounts throughout the arboretum and is comprised of different ecotones within individual plant community. Each community type is also present throughout areas of the arboretum designed to represent ecologically inspired landscapes as well as culturally inspired landscapes.

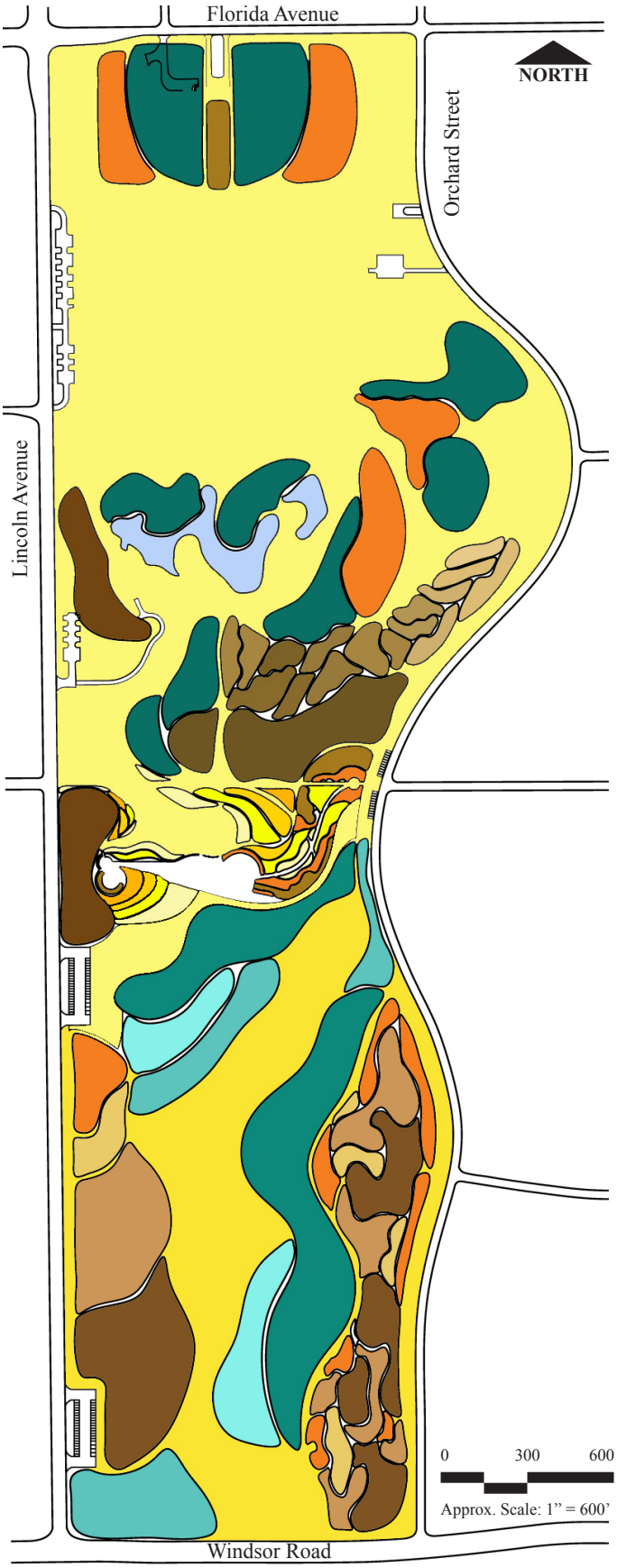

Figure 5.12
Plant Community Breakdown

Grassland

Woodland

Savanna

Shrubland

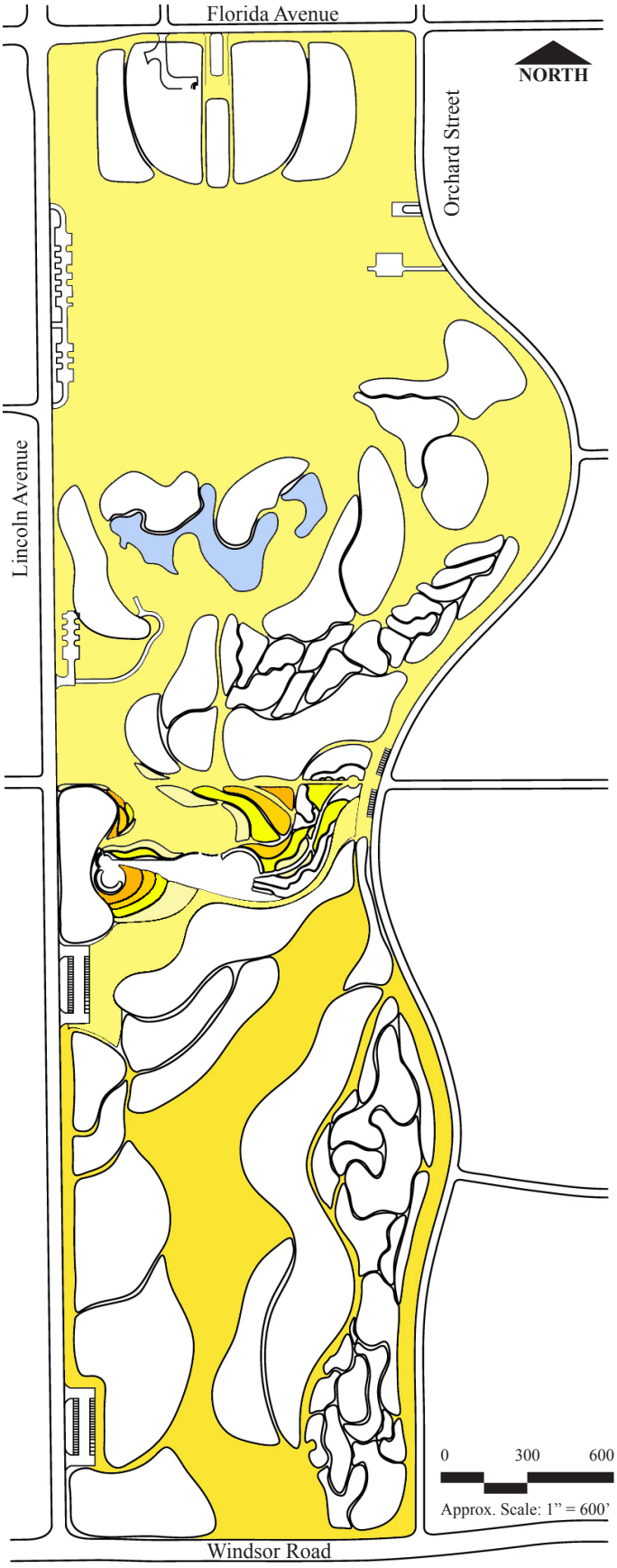

Figure 5.13
Grassland Areas

- Environmental Influence, Native Plant Species, Prescribed Burn (South)
- Cultural Influence, Native and Exotic Plant Species, Seasonal Mow (Discovery Center)
- Cultural Influence, Exotic Plant Species, Mown (North)

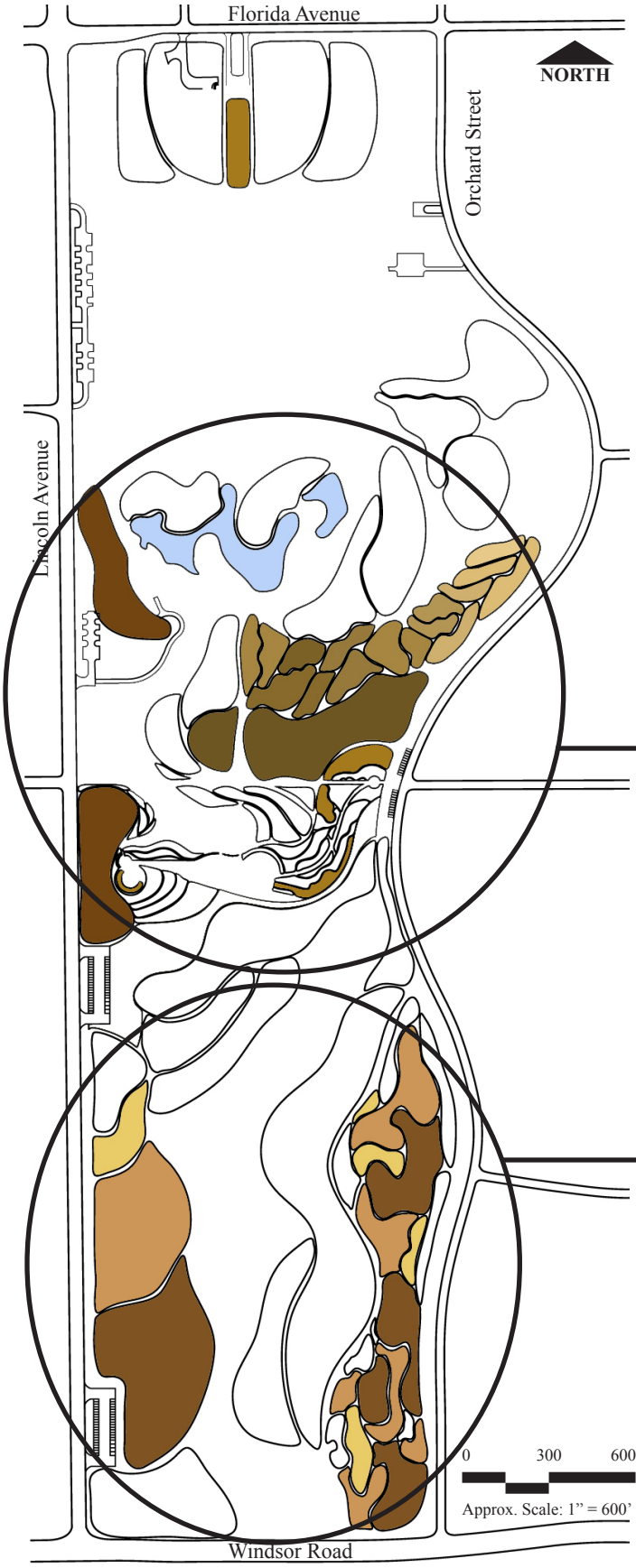

Figure 5.14
Woodland Areas

Cultural Influence, Horticulture Collections Area (North)

- Plants arranged by taxonomic family

Environmental Influence, Habitat Areas (South)

- Plants arranged to illustrate woodland succession (West) or a woodland mosaic (East)

Early Stage

Intermediate Stage

Late Stage

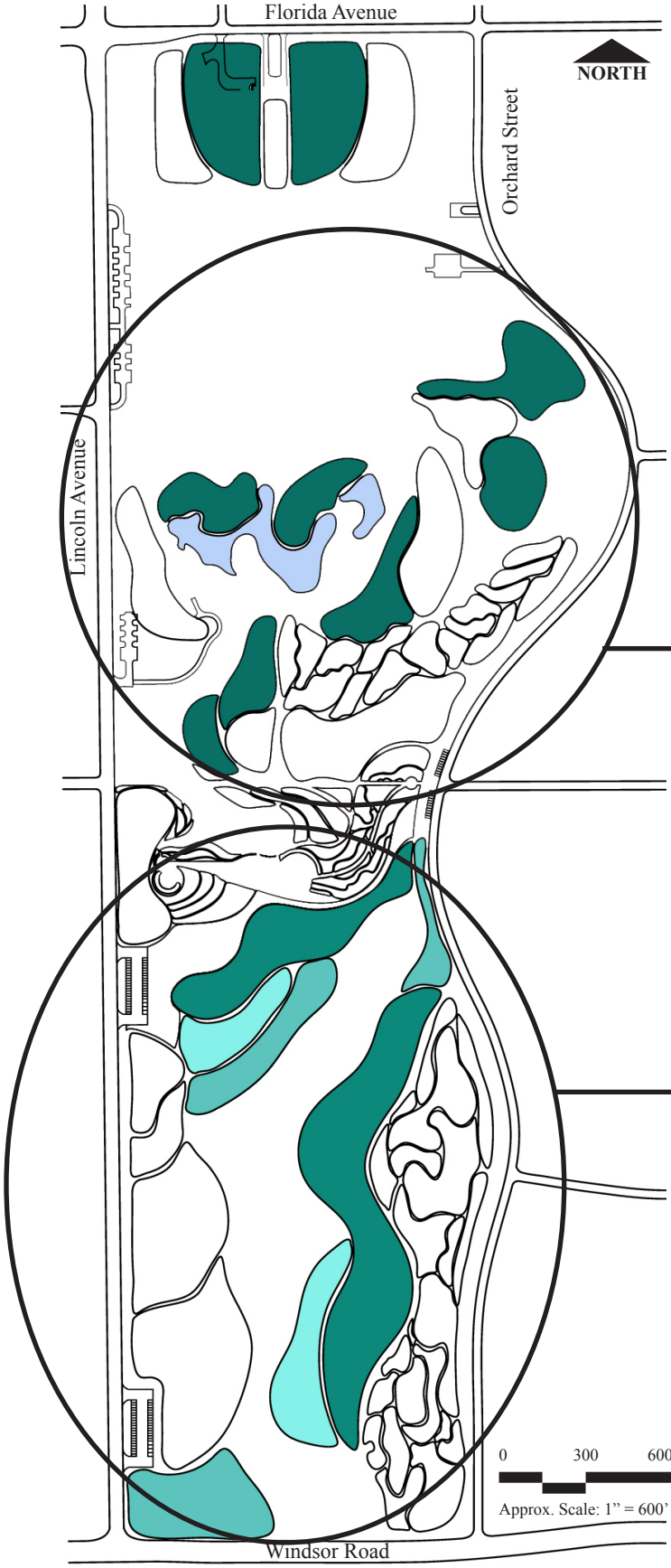

Figure 5.15
Savanna Areas

Cultural Influence, Horticulture Collections Area (North)

- Plants arranged by taxonomic family

Environmental Influence, Habitat Areas (South)

- Plants arranged to illustrate savanna succession by proximity to grassland (early stage) versus woodland (late stage)

Early Stage

Intermediate Stage

Late Stage

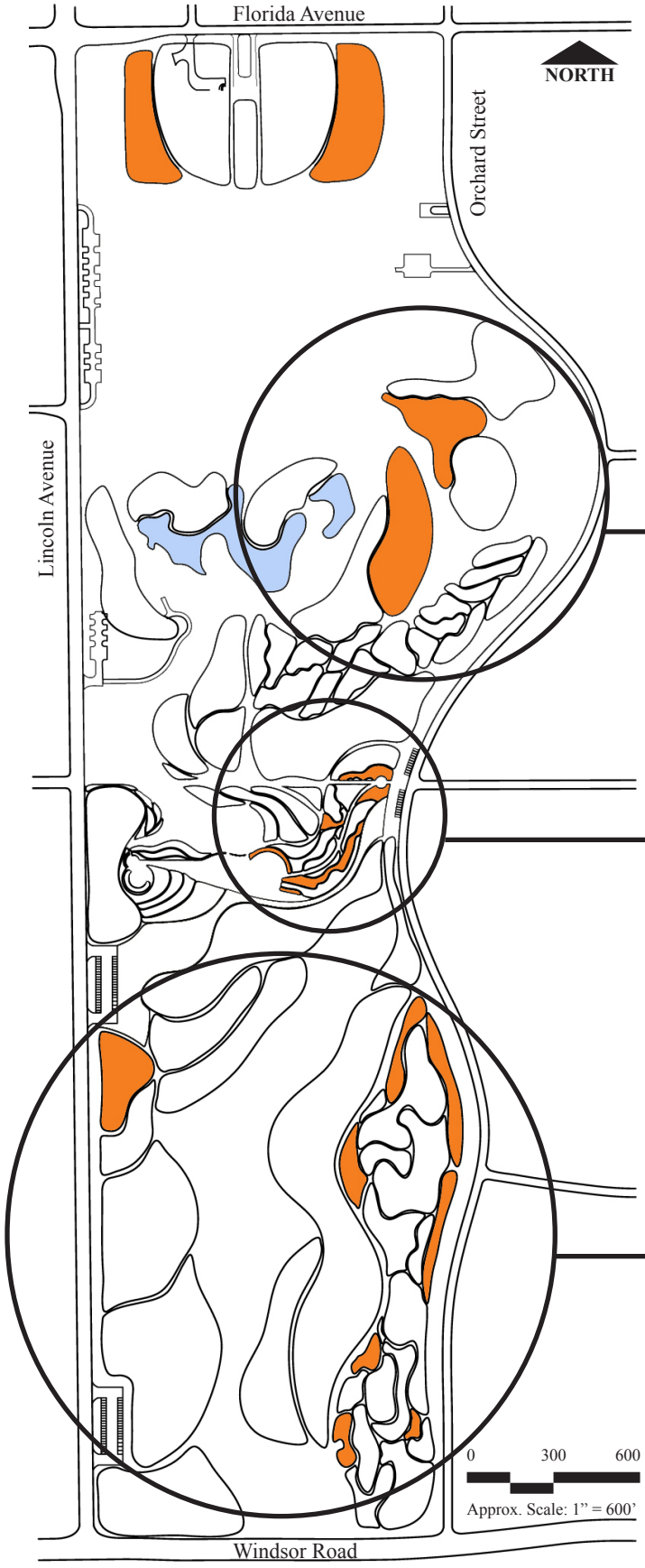

Figure 5.16
Shrubland Areas

Cultural Influence, Horticulture Collections Area (North)

- Plants arranged by taxonomic family

Cultural Influence, Discovery Center Area (Center)

- Plants arranged for ornamental display and intrinsic qualities

Environmental Influence, Habitat Areas (South)

- Plants arranged to illustrate shrubland succession as edge habitat

6.0 Conclusions

The culmination of this project brings to my mind two distinct notions; the first is a realization of the lessons I've learned while undertaking a project of this scope and intensity, and the second is an understanding that there is so much more that could be done to take this project forward toward realization in the future. When I began this project my thought was that it would be a simple matter of thorough site analysis followed by an exploration of the meaning and application of designing for the purpose of education, with the University of Illinois Arboretum as my testing ground. What I didn't recognize initially, was that as I gathered more information about the arboretum and its context within the community, my ideas about the relevance of the arboretum, and therefore my approach to designing the arboretum as a community amenity, would evolve and as such the design itself would evolve. Then, as I researched the different educational philosophies relevant to designing outdoor learning environments, I discovered that designing for education requires a multi-faceted plan to encompass the different approaches to education and provide an effective environment for learning. Finally, as I explored the ways that other institutions have striven to achieve similar educational goals to those that I had determined for the arboretum, I learned that the design possibilities for the University of Illinois Arboretum were not only vast but also exciting and complex, and would require a great deal of exploration, thoughtfulness, and trial and error to achieve the desired result.

When I began the process of developing this thesis project I had more ideas about different approaches for designing the arboretum, educational topics and program possibilities to consider, and elements to include in the design itself, than could reasonably be addressed in one project. In order to organize and simplify the project scope, I limited these ideas by focusing on the previously developed Master Plan and Program Statement for the arboretum. I did this to determine the direction of the design

project and narrow the possibilities for educational goals within the arboretum. I also chose to focus on varying user groups within the university community and local Urbana community as well as on the regional setting to identify ways to increase relevance of the arboretum and further isolate program goals that contribute toward increased visitation to the arboretum. This process enabled me to determine a design focus, namely the 10-acre Discovery Center site, as well as enabled me to develop a limited set of educational topics. As the design project progressed and precedent studies were analyzed, I realized that even within this narrowed project scope there were numerous elements to be considered thoroughly and designed in detail. The resulting thesis project has turned out to be, in my mind, merely the first phase of a process of designing for education at the University of Illinois Arboretum.

In this chapter my goal is to first summarize what has been achieved in my design for the arboretum thus far, and then to identify a plan for taking the project to the next level. In the first section, I will discuss the ways in which different aspects of my research for this project led to major shifts in the design itself, and I will explain what has been gained by allowing for these fundamental design changes. The following sections will outline in more detail some specific design elements that were touched upon in this project but that I would like to explore more thoroughly in the future. The purpose of this is to provide a launching point for the next phase of design development for the University of Illinois Arboretum; to provide the beginning of another project that is simultaneously this projects end.

6.1 Design Discoveries and Lessons Learned

The goal of this thesis project from the outset has been to develop of a framework for visitor experience at the University of Illinois Arboretum that focuses on educational programming and includes the design of a Discovery Center - a facility that serves as the locus for educational experience - at the core of the arboretum. The process employed toward this end began with research regarding site context, educational goals and philosophies, and precedent studies, which was followed by a series of design investigations that resulted in the final design for the arboretum.

Determination of the arboretum's context involved investigating the origin of the arboretum and the established mission and programmatic goals for the arboretum; gaining and understanding of the arboretum's unique situation within the local and university community; gathering information regarding site features such as topography, soils, and existing built elements; and evaluating plans for future development of the areas immediately surrounding the arboretum property. The key lessons I learned from these investigations are that the arboretum is not an isolated entity, it is part of a larger local green infrastructure, it is currently underutilized as both recreational and educational space, and it has a much greater potential as a community amenity than what has been realized to this point in time. The Master Plan and Program Statement developed in the 1990s had an understanding of this potential for the arboretum as well, but as time passed the circumstances literally surrounding the arboretum changed, and with that a number of doors opened that enabled a different approach to the development of the arboretum than what has been previously proposed.

The most important message to take away regarding the context of the arboretum, is that it does not exist isolated from its surroundings. In order for the arboretum to achieve community relevance it must interact with its community by acting as public greenspace, as a space for not only education but also recreation, relaxation, and even pedestrian transportation. Visitors to the future arboretum will not use the arboretum as

only a destination or weekend getaway; they will also use it as a preferred route between home and work or school. They will use it as a place to enjoy a peaceful moment between the busy moments of everyday life. They will use it as a place to spend time with family and friends on a regular basis. And from these interactions, visitors will learn about the meaning of an arboretum. By experiencing different areas of the arboretum, visitors will learn about plant genetics and morphology, about plant community development, and about the expression of intrinsic plant characteristics. And they will learn this only if the arboretum is designed appropriately, if the design includes the development of outdoor learning environments that function in a variety of situations and for variety of purposes.

In my design for the arboretum, there are two primary contextual factors that directed my design decisions toward the goal of establishing community relevance. The first, is the fact that in the near future the Orchard Downs community, which is immediately adjacent to the arboretum's east boundary, is going to be completely renovated. The second, is that in order to increase recognition and prominence of the Discovery Center, its position must be in an accessible location both visually and proximally to entrances and other arboretum elements. The redevelopment of Orchard Downs provides numerous opportunities for the arboretum and the new community to interact in mutually beneficial ways. Specifically, the arboretum becomes added neighborhood greenspace for the community, and the redevelopment of the community provides new means of access into the arboretum both by vehicle and pedestrian. With this idea in mind, I redesigned the layout of Orchard Street, which is essentially the boundary between Orchard Downs and the arboretum. This major change completely alters the footprint of the arboretum and provides a new way of thinking about how the arboretum functions. For example, the creation of a road at the neighborhood scale of two lanes and with a residential design speed of only 25 miles per hour provides a safe means of entering the arboretum on foot, a convenient means of entering from the east by vehicle, and has the potential to obscure the boundary between public and private

space by providing greenspace on both sides of the road. Additionally, the road redesign enables the incorporation of the Grand Hill within arboretum property, the meandering nature of the road creates a dialogue between the neighborhood and the arboretum while also enhancing the visual experience of the arboretum through a sequence of enclosure and revelation, and the redesign provides the opportunity to create a main entrance to the arboretum on its east side.

The second influential design decision was determining that the location of the Discovery Center was to be at the center of the arboretum situated on a slight topographical ridge, rather than at a location toward the north end of the arboretum where it had been originally proposed. The advantage of this location is that it is visually accessible from Lincoln Avenue while it is also distinct from other arboretum elements at the north end of the arboretum. Additionally, a location at the center of the arboretum places the Discovery Center optimally in regards to ease of access for many different types of educational programming throughout arboretum property. From this location, programs focusing on environmental education and habitat development have a view of the habitats to the south and a connection to trails through the different environmentally influenced plant community types. In the opposite direction, the Discovery Center is equally accessible for groups studying culturally influenced plant communities in the horticultural collections area and in the display gardens to the north. The advantage of this location is that the Discovery Center area can be developed essentially with a blank slate, without ruining the integrity of the existing arboretum elements to the north and without compromising the educational goals and facilities of the Discovery Center itself.

After making these influential design decisions about the layout of the arboretum and the location of the Discovery Center, the next step was to research educational philosophies applicable to the arboretum setting - outdoor, environmental, and experiential education - in order to determine how an arboretum can best be developed as an educational institution. The lesson that I ultimately learned from this research

was that it is necessary to facilitate different types of learning through the design of outdoor learning environments that satisfy programmed and unprogrammed educational goals throughout the arboretum. While I established a set of four educational goals for the arboretum - plant genetics and morphology, plant community development, the expression of intrinsic plant characteristics, and the development of outdoor learning environments - the latter goal is truly the most critical. My reasoning here, is that while the first three topics directed the design of specific spaces within the arboretum, namely the horticulture collections, the Discovery Center area, and the habitats area, the fourth topic directed the development of all spaces for educational experience within the arboretum. It involved the design of educational facilities at the Discovery Center, the development of a plan for educational nodes throughout the arboretum, and the introduction of a plan for visitor interpretation throughout the arboretum. The combination of these three design tasks established the framework for educational experience throughout the arboretum by making the educational goals accessible to the visitor and by promoting learning on any topic, not just those that I have outlined in this project. The successful design of educational spaces that promote outdoor education, environmental education, and experiential education, as well as provide the facilities necessary for educational experience within the arboretum, ultimately determines the success of the arboretum as an educational institution. This is exactly what I have attempted to achieve through the design of outdoor learning environments at the University of Illinois Arboretum.

In order to effectively design outdoor learning environments, I studied examples of precedents with educational goals similar to those of the University of Illinois Arboretum as a means of gathering information about possible ways to implement these ideas on site. The University of Illinois Arboretum is essentially a new arboretum, and as such, it can benefit from lessons learned and design concepts employed at established arboreta and other educational outdoor environments, as well as from examples of

relevant design concepts that have been constructed, that occur in nature, or that have been discussed in literature.

I isolated four precedents to study for very specific reasons: each precedent exemplifies one of the four educational goals established for the University of Illinois Arboretum in this thesis project. In my study of these precedents - the Washington Park Arboretum, Pinecote at the Crosby Arboretum, the American Woodland Garden by Rick Darke, and A Studio in the Woods - I learned the importance of four additional concepts necessary to effectively communicate the educational goals in an arboretum setting. These are: the importance of developing a wayfinding plan, the use of landscape journeys to tell a story, the use of the landscape design tactics to communicate ideas in the landscape, and the importance of the interplay between interior and exterior spaces in educational site design.

My study of the Washington Park Arboretum provided a resource for designing the horticulture collections area of the arboretum as a space for learning about plant genetics and morphology. However, it was the wayfinding plan of the Washington Park Arboretum that illustrated a method for communicating educational goals to visitors of the arboretum. The wayfinding plan uses a hierarchy of signage and interpretive nodes to assist the visitor in exploration of the arboretum, to highlight unique features of the arboretum, and to provide explanation for a variety of designed arboretum elements. In my design of the University of Illinois Arboretum, I used the idea of wayfinding to develop a system of interpretive nodes and signage types at the arboretum, while also allowing for uninterpreted visitor exploration of the arboretum.

Pinecote at the Crosby Arboretum is an excellent example of using an arboretum setting to teach people about plant communities native to the region. At Pinecote, a series of landscape journeys take visitors through each of the distinct plant community types in order to expose the characteristics of each community. I employed this method in the habitat areas of the arboretum for the very same reason. In my design of the arboretum

I have sought to illustrate the four native plant community types in Illinois - grassland, woodland, savanna, and shrubland - both as environmentally influenced and as culturally influenced landscapes. The habitats area of the arboretum illustrates the environmentally influenced versions of these plant communities. The implementation of landscape journeys allows visitors to progress through a sequential experience that exposes not only each of the plant community types but also tells a story of their succession in Illinois history.

My use of The American Woodland Garden by Rick Darke as a precedent is intended to illustrate the ways that the intrinsic qualities of plants can be highlighted through careful planning and design in the landscape. My goal was to illuminate the usage of subtle qualities of color, texture, light, and wind in the development of culturally inspired landscapes. What I additionally learned from this reference is that the same methods used to highlight individual plants, namely aspects of abstracting the forest, framing and enclosing, working with layers, encouraging natural form, and integrating exotics, can also be used to distill the essential characteristics of entire plant communities and tell a story about their development. I ultimately used this resource to help refine the theory of planting design that I applied to the design of the University of Illinois Arboretum.

Perhaps one of the most inspiring precedents I studied for this project was A Studio in the Woods, the Louisiana artists in residence community. At this particular site, a portion of bottomland hardwood forest was developed as an outdoor learning environment for aspiring artists and local students. The facilities at A Studio in the Woods effectively balance the relationship between interior and exterior educational spaces and the method of creating intrusions into the woods encourages exploration and enriches the learning experience. In my design for the Discovery Center, I focused on creating an effective relationship between interior and exterior educational space that would be flexible in function for various user groups with differing educational goals.

I also planned for extensions from the Discovery Center outward to other areas of the arboretum, which was inspired in part by the Studio's intrusions into the woods plan. These extensions entice visitors to explore outlying areas of the arboretum, thereby enriching the experience of the arboretum as a whole.

After all of the research described here, there were still many iterations of my design for the Discovery Center and the framework for visitation throughout the arboretum that took place before I arrived at the final design. I chose to expose these design explorations as part of this project so that the reader might follow the progression of the thesis in the same way that I experienced the project while it was being developed. I have presented the evolution of the design from a study of the expression of form in landscape, to a road development study, followed by a spatial relationship analysis, an architectural search to discover building prototypes appropriate for the Discovery Center, and finally as an expression of planting design philosophy. My hope in presenting this process is to illustrate and explain how certain design decisions came about and what factors influenced the design as the project unfolded.

The final design for the arboretum was a synthesis of research about context, educational philosophy, and precedent studies that led to a series of design explorations which finally, ultimately resulted in the design presented in this document. I have presented this design both graphically and in writing to provide as much insight as possible about my design ideas and goals for the University of Illinois Arboretum. I have illustrated and discussed each element of the Discovery Center - the building, the outdoor classroom, the eatery, the projection amphitheater, and the outdoor theater, and described their importance within the larger educational framework. I have presented my plan for visitor experience which includes a circulation plan, a wayfinding plan, and an interpretation plan. The planting design applications presented take into account the theory of planting design that I developed for this project and integrate this theory with the overall educational plan for the arboretum. The final design that I have developed

for the University of Illinois Arboretum is essentially an assimilation of each aspect of research, each design exploration, each idea and theory that I have developed about arboretum design throughout the course of this project.

While the final design is, of course, the finish line of this thesis project, it is inevitable that I have still more ideas of ways to further the process of designing for education at the University of Illinois Arboretum. In the following sections of this chapter, I will present my ideas for a hypothetical "Part II" of the project. These next steps consider the design work that has been done thus far, and make suggestions about ways to take specific elements to the next level of design. My goal in doing so is to emphasize that the design of the arboretum is an ongoing process, and to highlight a select few aspects of the design that I find particularly intriguing for further development.

6.2 Next Steps: Designing for Education, Part II

In the event that there were to be a "Designing for Education at the University of Illinois Arboretum, Part II," carried out in the future, what elements would be included in the project? I intend to answer this question by outlining aspects of the current thesis that are of primary importance to be developed in more detail and by pointing out ideas that have not been discussed here but that are relevant to the arboretum's design. Specifically, I will outline aspects of the Discovery Center that would benefit from a more in-depth design study, I will propose ideas for the development of a sophisticated wayfinding system within the arboretum, and I will suggest methods for establishing plant species lists and planting plans for various areas of the arboretum. Additionally, I will discuss design considerations that have not been presented in this thesis regarding renovations to existing display gardens on site and the incorporation of new amenities at the north end of the arboretum.

6.3 Detailed Design of Proposed Discovery Center Elements

In Chapter 5 of this thesis I presented the design of the Discovery Center and design of the educational framework and plant community development throughout the arboretum. A continuation of the design of these elements would include significantly more information by delving into design at a smaller scale, identifying the full range of materials to be used for hardscapes and landscape, and developing the construction details and illustrative details to communicate the design more thoroughly than what has been provided thus far. The next steps in the design for the arboretum, based on what I have discussed to this point, are furthering the detailed design of the Discovery Center facility, developing a planting plan for the horticultural collections and the habitats areas, and formulating a wayfinding plan with graphic details for each of the various wayfinding elements.

My design of the Discovery Center has effectively sited the facility within the arboretum, has identified programmed spaces to be incorporated, has organized these elements to take advantage of ideal usage and views, and has established functional relationships between these elements. The form and style for the design has been conceptualized, ideas for the basic materials palette have been identified, and a detailed explanation of the purpose of each programmed element from an educational and visitor standpoint has been developed. However, examination of these spaces in more detail is necessary to produce a design package that not only satisfies basic programmatic goals but is also presented in such a way that entices support of the project and that is complete with illustrative and construction documents.

In regards to the Discovery Center building, I have discussed the concept of integrating interior and exterior spaces and suggested modifications to the architectural plans by Lake Flato to increase the applicability of the building to an Illinois climate. The next phase of design for the building includes an examination of transitions between the building and its immediate surroundings. This includes identifying the relationship

between interior flooring materials and exterior paving materials and providing paving details and material specifications to illustrate this relationship; it also includes specifying the method for opening window panels in each building to create open-air circulation in moderate weather and methods of enclosure for winterization as well as cooling methods in summer heat. In order to communicate the experience of the relationship between the buildings and their location within the arboretum, it is necessary to produce perspective views outward from each building. A view north from the west building illustrates the relationship between the indoor teaching areas and nearby outdoor classroom, while a view south from the east building provides a panorama of the habitats portion of the arboretum. A 360-degree view from the north building illustrates the feeling of being outdoors while actually in an interior space.

The development of a design language through selection and use of materials throughout each element of the Discovery Center is critical to the creation of truly dynamic spaces that are intriguing individually and that are perceived together as a cohesive whole. The next step in the design of the outdoor classroom, the eatery, the projection amphitheater, and the outdoor theater is to study and select the specific types of wood, stone, and plant materials to be used. Once selected, construction details for built elements and a planting plan with varieties selected for the pocket gardens and culturally influenced plant communities are able to be produced for the areas immediately adjacent to the Discovery Center facilities.

For the outdoor classroom, the primary elements to be detailed that will develop its identity as a teaching space include the decking and the furniture, as well as selection of plant materials to provide enclosure at the perimeter and interest within the classroom pocket garden. Decking details will provide specifications for the layout of horizontal elements underfoot to communicate the differentiation between circulation space and classroom space; they will also provide construction requirements for safety mechanisms such as the toe-kicks and railings as vertical elements that integrate seamlessly with the

horizontal elements to create a unique, safe, and accessible learning space. Furniture details are critical to characterizing the style of the outdoor classroom as well as for providing usable workspace for programs and events. The furniture design will need to take into consideration functional aspects for children and adults as well as meeting design guidelines of the Americans with Disabilities Act (ADA). It is also necessary to consider the probability of theft in the design of furniture that is secure within the Discovery Center area, but has flexibility to accommodate groups of different sizes. Material and layout specifications, stains, finishes, and decorative elements of the decking and furniture will all contribute to the identity of the space within the Discovery Center and the arboretum. Elevations and sections through the outdoor classroom will be useful to communicate the character of the space, while illustrations of the space in use will communicate the effectiveness of the design in regards to educational programming.

Design details for the eatery are similar in purpose and scope to those of the outdoor classroom. The layout and dimensions of decking materials determine the character of the space while the design and layout of furniture communicates how the space is effectively used by visitors. The primary difference between the eatery and outdoor classroom, however, is that the detailing for the classroom is intended to provide a sense of enclosure and moderate privacy with seating for student groups of ten to forty people whereas the detailing for the eatery is directed toward views southward and has seating accommodations for small groups of two to five people at each table. A perspective drawing of the eatery is useful in illustrating its usage as a space for relaxation and socialization within the setting of the arboretum that has expansive views of the habitat areas.

The next step in design of the projection amphitheater is primarily the development of sections, elevations, and perspective drawings to depict the broad terracing of the space and then to work out the technical aspects and requirements for the projection screen and media boxes. The viewing area is designed to be made of wide

lawn terraces with stone risers; further design requires selection of stone, determination of stone sizes, color range, and riser heights, integration of stone risers with steps and pathways along amphitheater perimeter, and determination of grades and drainage in this area to provide smooth transitions for pedestrians and prevent pooling of rainwater at low points of the amphitheater. Provisions for electricity and internet access, weatherproofing for the media boxes, and designing a permanent weather-tolerant screen that aesthetically coordinates with the east building when not in use will all be critical aspects of the projection system, .

The primary considerations in further developing the outdoor theater are designing patterns of pedestrian circulation to the seating areas as far as location and orientation of stairs and ramps, selecting materials and design specifications for the seating itself, determining any special requirements for the stage area, and developing a unique design language to identify the space that is distinct yet coordinates with other Discovery Center elements. Regarding the planting design in this area, the outdoor theater has specific screening requirements for noise reduction and visual separation from Lincoln Avenue. The planting design also incorporates ornamental features immediately surrounding and within the theater and is planted to take advantage of views oriented to the north portion of the arboretum of plant communities and display gardens. Perspective drawings will most effectively communicate the character of and views from the outdoor theater, whereas section drawings and construction details will be necessary to communicate the design of the theater itself.

Essentially, the next design phase for the Discovery Center area involves two approaches: considering the design at detail scale to work out the intricacies of connections within and between built elements, and evaluating the design from a three-dimensional perspective to produce a higher level of design detail and effectively communicate this level of detail to others. Additionally, this phase includes making decisions about creating a design language to create cohesiveness within the Discovery

Center area while also distinguishing a unique design character among the various Discovery Center elements.

6.4 Development of a Wayfinding Plan

A wayfinding plan is a system of communicating information to visitors at the arboretum. The purpose of a wayfinding plan is to enhance visitor experience not only by providing information regarding direction and location but also by communicating a degree of meaning and purpose of the arboretum to the visitor. In the case of the University of Illinois Arboretum, a sophisticated wayfinding plan involves developing a graphic communication palette throughout the arboretum to be used in signage and printed materials as well as a design palette for structures and landscape elements at wayfinding nodes within the arboretum. The purpose and intent of a wayfinding plan has been discussed in Chapter 5 of this project, however the specific wayfinding elements have yet to be graphically designed and detailed. In order to implement a wayfinding plan, a graphic document that includes construction specifications for each element must first be produced--the production of such a document could be a thesis project in and of itself.

Four types of signage were identified in Chapter 5: arboretum entry signs, arboretum attraction signs, interpretive signs, and botanical signs. Design of each sign type involves developing a graphic language regarding the materials and size of the sign itself, text characteristics and printing methods, and basic layouts for graphic images included in the sign design. The next step once a design language has been established is to formulate the content for each type of sign. For example, arboretum attraction signs would simply state the name of the attraction or element to be identified, whereas the content possibilities for interpretive signs used within each area of the arboretum is seemingly limitless. Once the thematic idea for content of each sign type is developed, the final step is to literally design each sign to be used in the arboretum. The wayfinding

plan would include construction documentation for each of the four signage types, as well as sample graphics with dimensions, font styles, colors, and image samples to detail the content of the signs.

The printed materials for the arboretum are similar to the signage in that they are to have a consistent graphic palette and style to contribute to establishing arboretum identity to the visitor. Ideally, a set of templates would be created that effectively serve the needs for different types of printed materials so that as new documents are produced they can be easily created using the templates. Possible templates include a tri-fold 8.5”x11” brochure and a double-sided 8.5”x11” information sheet. The templates could be set up in such a way that type-in-text fields have the designated font style, size, and placement for headings and content, that drop-in spaces for images are pre-located and sized within the template, and that the arboretum logo and contact information is consistently placed on the printed document. The wayfinding plan would include samples of these templates illustrating the method of communicating information and explaining how these templates are used to create additional printed materials for programs and events at the arboretum.

In Figure 5.11 a map of the arboretum indicates locations of primary and secondary interpretive nodes. These nodes serve a variety of visitor functions in the arboretum by distributing information, providing shelter and amenities, and providing places for relaxation. The development of a wayfinding plan would include construction details for structures such as pergolas, pavilions, and kiosks located at these nodes as well as an indication of the location for each type of structure based on visitor usage within a particular area of the arboretum. It also could include furniture specifications and indications of signage types to be used in conjunction with the structures at each node in order to maximize visitor experience throughout the arboretum.

Overall, the wayfinding plan is intended to include detailed information describing the construction, intent, and content of each wayfinding device employed in

the arboretum. These devices include signage, printed materials, and structures to be located throughout the arboretum for the purpose of enhancing visitor experience by providing amenities and information along the arboretum journey.

6.5 Development of Plant Lists and Planting Plans

Throughout this thesis I have discussed planting design for the arboretum from a few different perspectives. In Chapter 3 I describe the educational goals of plant genetics and morphology, plant community development, and expression of intrinsic plant characteristics. In Chapter 4 I reveal a theory of planting design that is based on a matrix of cultural and environmental influences, plant community composition, and decisions about the role of natives, exotics, and invasive plants. In Chapter 5 I apply these ideas in the design of the arboretum by mapping out the four plant community types of grassland, shrubland, savanna, and woodland throughout the site and explaining the role of ecotones within each of these communities.

The next step in developing an effective planting design for the arboretum is to begin by creating plant lists for each of the four different plant communities (grassland, shrubland, savanna, and woodland). The plant lists will at first be broad in scope, potentially identifying more species and varieties than will actually be used in a given area. From these lists, more refined plant lists could be created that begin to identify the key differences between the plant communities in different parts of the arboretum. For example, the grassland plant list in the habitats area would be based on ideas for replicating historical Illinois prairies and would focus on environmental influences in the landscape. The grassland that transitions to the Discovery Center area, however, would incorporate ornamental grasses and perennials to add another layer of interest in the high use area and to illustrate cultural influences on the landscape. These differences in purpose lead to differences in the revised plant lists for these areas.

Following the development of plant lists for each area of the arboretum, the planting design composition would be further refined by consideration of the percentages of different plant types and species in different areas. By definition, any woodland area has eighty percent canopy cover and twenty percent shrub mass and perennial understory. The woodland areas differ from each other by species composition given these parameters. Different ecotones can be expressed within the woodland by varying the percentages of species to illustrate the differences between an early or late stage woodland, or to illustrate the difference between an oak-hickory versus a maple-beech woodland. The method of varying percentages of plant material types and species composition applies equally throughout each of the four plant community types in the arboretum.

Once these detailed plant lists have been developed based on the educational goals in each area of the arboretum, the planting design can take place. The design involves development of detailed planting plans, roughly at a scale of one-inch equals ten-feet, to illustrate the locations, quantities, and spacing of plant varieties throughout the arboretum. Planting plans will differ based on the most effective way to communicate the character and installation of the design. In the Discovery Center area a planting plan would indicate specific plant varieties and their precise locations because they will be installed individually. Conversely, planting plans for the habitats areas would quantify a square footage of a plant mix and its method for application, such as hydro-seeding in the grassland areas, but would not specify the precise location of each individual plant.

Documentation of the planting design for the arboretum consists of both landscape plans and tables with additional information. The landscape plans, as mentioned, identify the locations and quantities of plants and refer to the tables for further explanation. The tables are essentially the lists previously mentioned, organized by plant community type and location within the arboretum and including information about each plant and its usage in the landscape. The tables will provide the scientific and

common names of plants, mature size in the landscape, cultural requirements for soil characteristics and light exposure, potential pests and diseases, and ornamental seasons of interest. The combination of landscape plans and tables will effectively communicate the planting design goals throughout the arboretum property.

6.6 Additional Design Elements to be Addressed

This project has focused largely on developing areas of the arboretum property that are not currently in use for arboretum purposes. In doing so, the north end of the arboretum that includes the Hartley Gardens, the Idea Garden, and the Japan House and Gardens have either been left as is, or drawn according to previously developed plans for the north portion of the arboretum. While the inclusion of display gardens within the arboretum fulfills many of the educational programmatic goals discussed in this thesis, a complete redesign or analysis of these areas was not included within the scope of the project. Another phase in the design of the arboretum as an educational institution would involve evaluation of existing arboretum elements on site, consideration of incorporating new elements proposed in the program statement for the arboretum at the north end of the property, and integration of existing arboretum elements with the proposed design for the entire arboretum site.

The first step in considering existing elements of the arboretum as educational amenities is to evaluate the gardens as they are today with the intent of identifying elements that need renovation or complete removal, as well as elements that are functioning effectively and should remain as they are. Following this analysis, a redevelopment and improvement plan for the future of each area of the display gardens could be integrated with plans for new gardens that are not yet in place. Another consideration at the north end of the arboretum is the relocation of existing horticulture production and maintenance facilities to an area that is both easily accessible for equipment and personnel but is also discreet in location and separate from the public

areas of the arboretum. The new facilities should be designed to accommodate future expansion of the arboretum in order to support a larger arboretum infrastructure and greater production and maintenance requirements.

In addition to evaluating, renovating, and relocating existing arboretum elements, the design of the north end of the arboretum should take into consideration the possibility of adding a visitor center and public greenhouse facility as proposed in the Program Statement for the arboretum. While a visitor center and greenhouse at the north end could be effectively used for educational purposes, the primary intent would be as a welcoming facility to provide information about features, activities and events within the arboretum and to direct visitors toward further exploration of the site.

A final aspect in the design of the north portion of the arboretum is integrating the ideas and concepts expressed in this thesis project with any proposed changes for the north end. This involves applying the design palette regarding materials and finishes for all hardscape and landscape elements in the Discovery Center area to the display gardens area, incorporating wayfinding devices in the style proposed for the entire site, and applying the theories in planting design suggested in this document to the development of ornamental displays.

6.7 Final Notes

In conclusion, while the final design for the arboretum framework and Discovery Center is the culmination of this thesis, it is only the beginning of the process of developing and carrying out a project that can be brought to fruition in the field. The usefulness of this project lies in its in-depth consideration of site information, community elements, and the Program Statement for the arboretum, in conjunction with the development of educational goals and planning for visitor experience to create a comprehensive view of the arboretum as a relevant local and regional institution. My hope is that this document will be used as a tool to provide information and to support and defend the mission of the arboretum both as a place for education about the role of plants from an ecological and cultural standpoint and as a place that promotes the cultivation of an individual and collective human environmental ethic. Designing for education at the University of Illinois Arboretum is a long-term process that has the potential to ultimately lead to the development of an interesting and beautiful university amenity. The future arboretum has the capacity to draw visitors to the university, entice students to pursue environmental fields of study, establish and expand campus identity southward, and contribute to advancements in the fields of horticulture, landscape architecture, environmental education, and numerous other academic and professional fields.

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